gineering
rary

Founded 1874—Fifty-One Years of Service

Electrical World

McGraw-Hill Company, Inc. *November 28, 1925* Twenty-five Cents Per Copy

NOARK

Ten reasons

why Central Stations should use the

NOARK Meter Service System

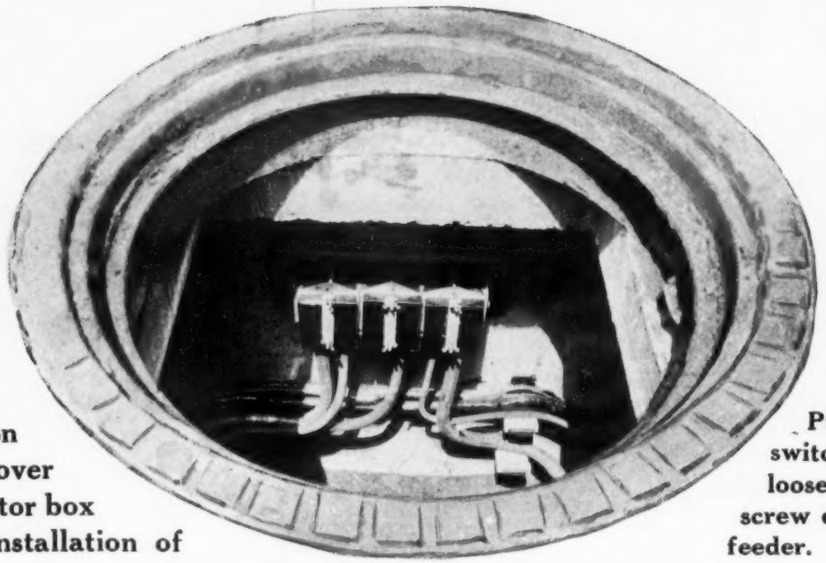
1. Complete line meeting all central station requirements.
2. Reduces service maintenance and investment.
3. Eliminates fire hazard.
4. Safeguards the customer.
5. Eliminates tampering and current thefts.
6. Provides service lock-off.
7. Provides meter testing facilities.
8. Same devices used for banked or single installations.
9. Good workmanship and fine appearance.
10. Noark pioneer experience.

TRADE MARK
PROTECTION SERVICE
JP
REG. U.S. PAT. OFF.

TRADE MARK
REG. U.S. PAT. OFF.

THE JOHNS-PRATT COMPANY, *Hartford, Conn.*
Division of Colt's Patent Fire Arms Mfg. Company
BOSTON · NEW YORK · CHICAGO · SAN FRANCISCO
EXPORT DEPARTMENT, 30 *Church Street* · *New York, N. Y., U. S. A.*

NETWORK



View taken through cover of distributor box showing installation of

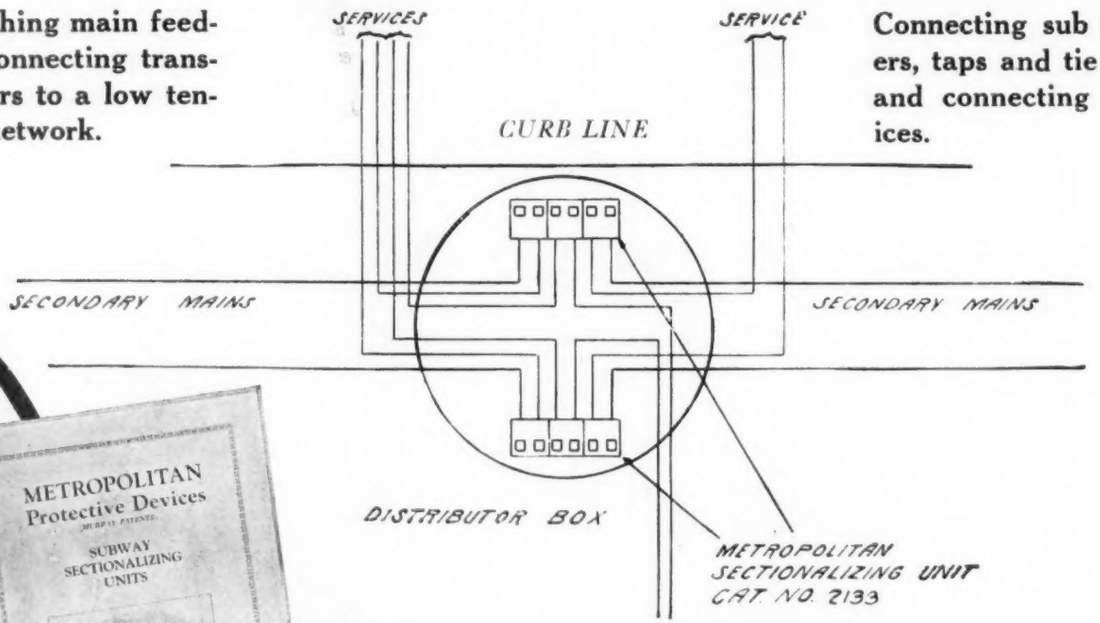
Pulling of a switch blade or loosening of a screw disconnects feeder.

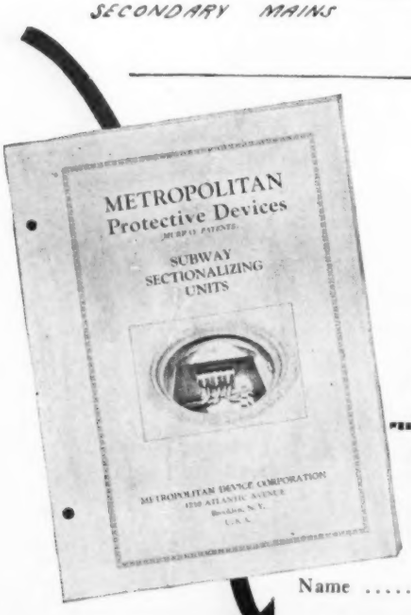
Metropolitan Subway Sectionalizing Units

Offering the most economical and convenient way of

Branching main feeders, connecting transformers to a low tension network.

Connecting sub feeders, taps and tie lines and connecting services.





Wiring diagram of installation pictured. The neutral wire of the three wire secondary is not shown to avoid confusing the drawing. The neutral connections are tied in solid.

METROPOLITAN DEVICE CORPORATION
1250 Atlantic Avenue, Brooklyn, N. Y.

Gentlemen: Please send 16-page catalog describing Metropolitan Subway Sectionalizing Units.

Name ..... Company .....

Address ..... Title .....

Electrical World

Published by McGraw-Hill Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 86 — *New York, Saturday, November 28, 1925* — NUMBER 22

The President Sounds an Encouraging Note

IT IS very encouraging to find that President Coolidge has grasped the economic trend of the times. In a notable address in New York last week he exhibited a knowledge of business essentials and announced a business philosophy that clearly show his mastery of new economic conceptions. He gave to business a social interpretation that was needed.

"True business," he said, "represents the mutual organized effort of society to minister to the economic requirements of civilization. . . . It rests squarely on the law of service. It has for its main reliance truth and faith and justice. In its larger sense it is one of the great contributing forces to the moral and spiritual advancement of the race."

These clearly stated principles are not platitudes. They form the platform upon which business is advancing in this nation of workers, and they include the social significance of the present business consolidations. They show that big business should be created and operated with a sense of obligation to the public which will stimulate national prosperity. With such a sound grasp of business essentials in the high places of the government, it is incumbent upon business to adopt and carry out the President's platform.

Increasing Water-Power Development

WHEN the electric light and power industry was urging Congress to enact a workable water-power law it contended that development was at a standstill, not because the industry was not willing and anxious to harness the streams running to waste, but because under the then existing statutes hydro-electric development was too hazardous and financing was impossible. Of course, there was much skepticism over the attitude of the industry at the time, many members of Congress feeling that the bankers and the power companies were asking the country to offer them priceless gifts on silver platters. However, after much debate the present water-power law was enacted and to the industry there was given an opportunity to prove its case.

The Federal Power Commission in its annual report, just issued, indicates to what extent the electric light and power industry has made good its boast. In the five years since the enactment of the law 180 licenses have been issued. Together with seventy outstanding permits, these involve a development of 8,745,000 hp. Of this total 2,646,000 hp. had been completed or was under construction on June 30. And yet this is only part of the story. The power applications, eliminating duplication, contemplated construction of projects aggregating 24,000,000 hp. Neglecting those which under present conditions are dubious, the aggregate of projects reasonably certain of development in the near future involves twice the water power in operation in 1920, when the law was enacted. This is a wonderful showing, creditable alike to the Federal Power Commission and the electric light and power industry, and amply vindicates the latter's claim that, given a workable law, water-power development would be rapid and certain.

Budget Season Calls for Planning

REPORTS indicate that the electrical industry sees a prosperous year ahead. Budgets are being made on a correspondingly large scale, and each business is trying to allocate its part of the total planned expenditure of about a billion dollars in new capital. Operating staffs find budget making a difficult and arduous task added to their daily jobs and sigh with relief when the ordeal has been passed. An intelligently made budget calls for detailed studies and analyses. It calls for a long time perspective on the growth of business, and it calls for very competent men to institute it as a means of control in actual operations. A business or a utility of any size should form a budget or planning department to do work of this kind, and the operating organization can then be used for consultation and for checking totals.

Executive thought should be given to the methods used in forming budgets and planning system developments. The day is past when hit-or-miss budgets, developments made on the basis of opinion and guesses on expenditures should be tolerated. Budget making and development planning are real jobs and should not be added to the tasks of the already overloaded operating departments. The best place to save money is in budgets, and the best way to avoid mistakes in developments is to have a plan.

Uniform Rates Versus Business-Getting Rates

A LARGE manufacturer desired to install a complete equipment of industrial furnaces for a uniform twenty-four-hour production program. He was convinced that electric heat was best and most convenient to use, but found that the rate for power from a small utility company was beyond the economic point under the particular circumstances and therefore installed fuel-fired furnaces instead.

But here is his chief criticism: "The utility offered me the same rate it gives a neighboring manufacturer who has a small five-hour load with a big demand and many peaks in his load curve. My load is large, it is uniform all the twenty-four hours, it is high-power-factor, and I am on a single feeder of sufficient capacity to carry the new load and only half a mile from the generating station. It doesn't seem equitable for me to pay the same demand and energy charges as my neighbor, nor does it appear that the utility encourages the development of business that will benefit itself and all other customers through load-factor and power-factor improvement."

This is a special case, but there exist very similar

situations on many properties. Some utilities have sought relief through the adoption of class business rates, greatly subdivided rates or special off-peak and demand rates. Others insist on a single power rate for the sake of simplicity and of uniformity. In essence it is a problem of fixing several rates to get the business available or of striking a mean to obtain a uniform rate that is easy to administer and yet difficult to apply to certain classes of business.

While there remain many possibilities for developing new business the uniform rate should not be sought too strenuously. At least each property can well study possibilities and in addition to fixing a uniform rate utilize some special rates to develop the three or four loads that offer the greatest prospects for the future. The greater the output and the better the load factor, the more uniform and the lower will it be possible to make power rates. Rates to encourage business with a good load factor should be instituted in the present stage of electrical development.

Icemen Take Common-Sense View of Refrigerator Situation

ALTHOUGH the ice-manufacturing industry has been slow to take cognizance of the domestic electric refrigerator, it is plain from the discussion at the recent convention of the National Association of Ice Industries at Los Angeles that ice manufacturers are now fully alive to the menace it contains to their business. A comprehensive report dealing with all phases of the situation was made by the committee on household refrigerating machines. This report contained some information of especial interest to electrical men, coming as it did from interests not altogether favorable to the cause of the small household machine. It was estimated that in 1925 the icemen lost $10,000,000 in gross revenue on account of the two hundred thousand domestic machines in use and that by 1930 this loss will have reached the total of $70,000,000. To combat this the committee recommended that an intensive educational campaign be launched to educate the public to use more household refrigeration, hoping thus to create a wider market which will offset the loss in revenue due to the mechanical refrigerator.

In the discussion which followed the presentation of this report it was clear that there is a very definite sentiment in favor of distributors themselves going into the sale of the electric household machine. This is predicated on the theory that the local ice companies can easily establish themselves as recognized authorities on refrigeration and by taking advantage of their delivery men to gain customers will be able to realize sufficient profit on the sale of mechanical refrigerators to offset the loss in revenue from the sale of ice for many years to come. It was further brought out that a movement is already on foot to enlist the co-operation of the N. E. L. A. in a national advertising campaign to sell more refrigeration of all kinds in the home. This movement would be carried out along the lines of the advertising campaign recommended by the committee on household refrigerating machines, but would include the electrical industry as well as the ice industry.

It goes without saying that the sale of domestic electric refrigerating machines by ice distributors would be most welcome to central-station companies and manufacturers of domestic machines, and it is certain that the electrical industry will give careful consideration to the co-operative advertising proposal. In any event the ice-manufacturing industry is to be commended upon its common-sense attitude toward the situation.

Study the Limiting Factors in Industrial Heating

A RAPID development like that of industrial electric heating literally bristles with unsolved problems. Herein lies the fascination of the field for designing, manufacturing and application engineers. Without the least detraction of credit from the pioneers in this branch of the electrical art, a word of warning against overlooking limitations may be timely. J. G. Learned stressed this effectively in the November 14 issue of the ELECTRICAL WORLD from the standpoint of competitive heating methods, and, supplementing his views, more attention may well be devoted to removing limitations temporarily resident in electric heating equipment itself. Here is an opportunity for closer co-operation between the central-station power sales engineer and the heating equipment manufacturer, in view of the entrée possessed by the former into the heart of industry and his exceptional facilities for informing himself as to the initial difficulties, if any, and any other troublesome experiences associated with heat applications in new fields.

Some criticism on a small scale has been heard, for example, of the delicacy of temperature-control equipment in certain instances; another point lately brought up is the importance of accessibility of heating units, and a complaint encountered in a recent field trip was based upon air-leakage troubles due probably to defects in refractory material. In one shop a core oven was reported to function unsatisfactorily on account of inadequate wattage in relation to its dimensions, so that the principal use the device degenerated into was the baking of potatoes for the day shift's noon lunch!

It would be strange indeed if the path of progress in a development making such superb advances as electric heating was not bordered occasionally by the results of mistakes in design and application, and it is no disgrace that this is so. Nowhere, however, is there more incentive in industry to benefit from the study of limitations than in the electric heating game, and it will pay all engineers connected with this field to concentrate upon such study in the spirit of enthusiasm that its increasing and admirable successes encourage in them.

A New Problem in Inductive Interference

POWER transmission and distribution engineers had just begun to look confidently toward a satisfactory inductive co-ordination with telephone circuits when a new problem in interference was thrust upon them, this time on the part of steam railroads. Automatic control of trains—that is, track signals repeated on the locomotive, causing the brakes to be applied automatically in the danger zone—is gradually coming into use. Some recent bad wrecks will probably accelerate further legislative or administrative action in this direction. It appears that the extreme sensitivity of the majority of automatic train-control systems now available has given rise to a number of sweeping requests from railroad companies to the electric indus-

try for wide separation between transmission and distribution lines and railroad rights-of-way on which train-control systems are to be installed.

H. S. Phelps, of the inductive co-ordination committee of the N. E. L. A., calls attention to the magnitude of this new problem in the following words: "Unfortunately, the indications are that not only transmission and distribution facilities are involved in this matter, but that this new problem also involves secondary or low-voltage circuits and equipment. The present equipment is, in most cases, extremely sensitive to currents of moderate magnitudes irrespective of the voltage between conductors. It is, therefore, readily apparent that it may be even more difficult to find relief from a low-voltage current of considerable magnitude within the buildings of an industrial establishment closely adjacent to the railroad tracks than from a current of considerably less magnitude at voltages many times as great."

Of course, an engineer's life is just one nice problem after another, and most engineers do not expect to be entirely free from operating troubles even in the blest hereafter. So there is no need to take a pessimistic view of the newly arisen problem by any means. While on the spur of the moment it is not easy to visualize the particular circuit that would do away with this troublesome interference, one can see at least three principles on which to proceed to a solution. These are: (a) Do not write cold official letters; go and see the other man's face and get his point of view. (b) Look upon the problem from the broad point of view of national equity and public good will. (c) Keep the lawyers away.

Impressions of the Jobbers' Convention

MEN who were present at the annual winter meeting of the electrical supply jobbers last week at Buffalo brought away with them a very definite impression that the wholesalers of the electrical industry are attentively reading the handwriting on the wall. There was evidence of a more alert recognition that times are changing rapidly in the jobbing business. For the increased centralization of the power industry is taking away from the jobber much of his most substantial trade inasmuch as many local central stations that have bought from him for years are now supplied through the headquarters purchasing office of the holding company as specified by its engineers. The question is, What is the jobber going to do about it?

Naturally no one can stem the evolutionary tide that has brought about these combinations of scattered power plants in order to effect economies of operating, financing and management. The concentration of purchasing in New York or Chicago, where most of the holding companies are domiciled, aims to take advantage of the better prices that are obtainable on larger quantities. The fact that this is putting an end to much local buying is, of course, a secondary reaction, and the industry in all its branches can only adapt itself to the new conditions. But, as is so often the case with such trends in industry, restriction in one market is attended by expansion in another, and the change comes slowly, with ample time for readjustment.

It is a fact that as more local power companies are tied into these great systems the jobber is fast losing much of his central-station market for construction materials and engineering supply equipment both large and small. The local manager no longer buys them. But there is another class of goods that he does buy and in increasing volume. He buys appliances, both domestic and industrial, and the drift in holding-company circles is strongly against the purchase of this resale merchandise at headquarters. For it is recognized that the local manager must be the best judge of what he can sell in his own town, and he cannot be held responsible if he is loaded up with stock that is not well chosen for his community.

So while the jobber sees a dwindling market for the old time central-station supply line, he also sees an expanding market for household appliances and other resale merchandise. He sees the need for a new attitude toward creative selling and highly organized service, and the spirit of the convention was running that way.

Lamp Wattages in the Home

PRIMARY interest in lamp wattage in sockets embraces the viewpoint of adequate illumination. Wattage also represents connected load, and obviously as it is increased the central-station revenue in general increases. However, all sockets are by no means of equal importance; that is, they are not equal in value from a lighting viewpoint and they are not equally active in creating revenue. Without knowing what the wattages in various fixtures in different rooms are, the central-station company must work blindly in its attempts to improve residence lighting. M. Luckiesh presents some data in this issue which make it possible to choose the most promising points in developing residential lighting and revenue. Such data have already proved of great value to electric light and power companies and others in planning campaigns for better lighting in the home.

As an example of their usefulness Mr. Luckiesh discusses the case of the kitchen and specifically treats the possibilities existing in various cities. He also emphasizes the value of the daylight lamp in lighting and in revenue getting. Very interesting data are presented which show the percentages of lamps of various sizes in the home. The wiring and lighting equipment average approximately the same for various places in this country, but the percentages of lamps of different sizes vary considerably. The influence of free-renewal policies is strikingly shown, and this is of even deeper significance, for it shows that the central station is a powerful influence in guiding the use of lamps. It may even be argued that the incentive to the householder need not be free renewal, for if this has really the influence it apparently has, might not other incentives be devised? In fact, even where the free-renewal policy is not in effect, it seems possible that publicity and pressure of other kinds could influence the use of this or that wattage.

All in all, the data in this article are of very great importance, for they provide knowledge which makes it possible for the central-station company to plan campaigns for the benefit of itself and the householder. It has been shown in these columns that an increase of 25 watts or 50 watts in active sockets may increase the net revenue 50 or 100 per cent respectively. Surely the alert executive will find various opportunities of greatly increasing net revenue from the information which Mr. Luckiesh has presented in this article.

A 110-Kv. Line Erected on City Streets

IN ORDER to meet the growing demands of the city of Toronto, the Hydro-Electric Power Commission of Ontario has built a four-circuit, 110-kv. steel tower line into the heart of the city. Great care was used in constructing the line in order that a maximum of safety might be attained and that the towers should not only be inoffensive but should add to the beauty of the city.

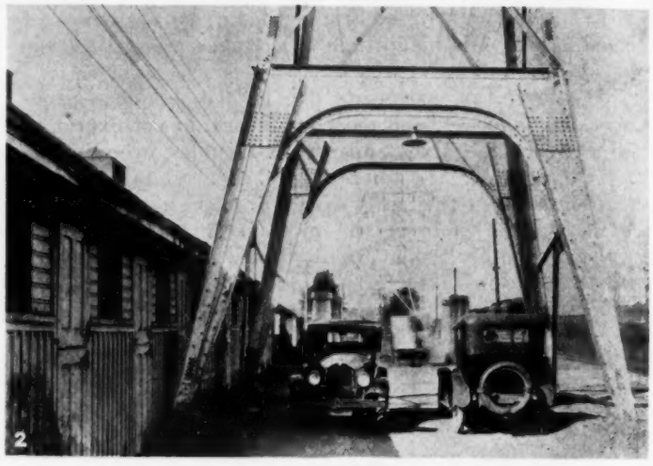
The suspension towers weigh 26,800 lb., the semi-anchor towers 35,000 lb. The circuits are 605,000-circ.mil aluminum steel reinforced cable with an average span of 700 ft.

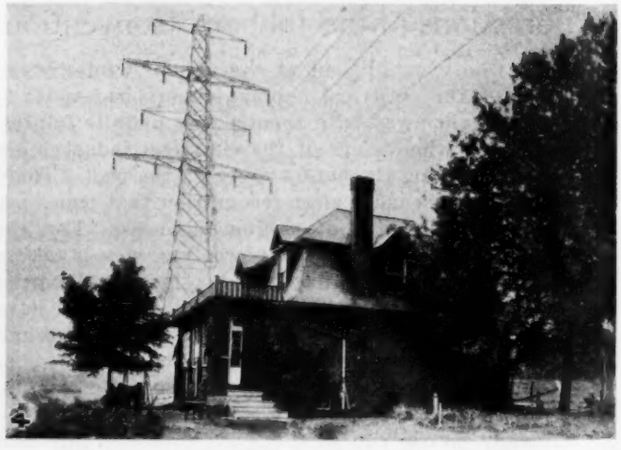
Nos. 1 and 5—The line runs along the lake front, and its towers have an Eiffel effect, which adds to the attraction of the boulevard.

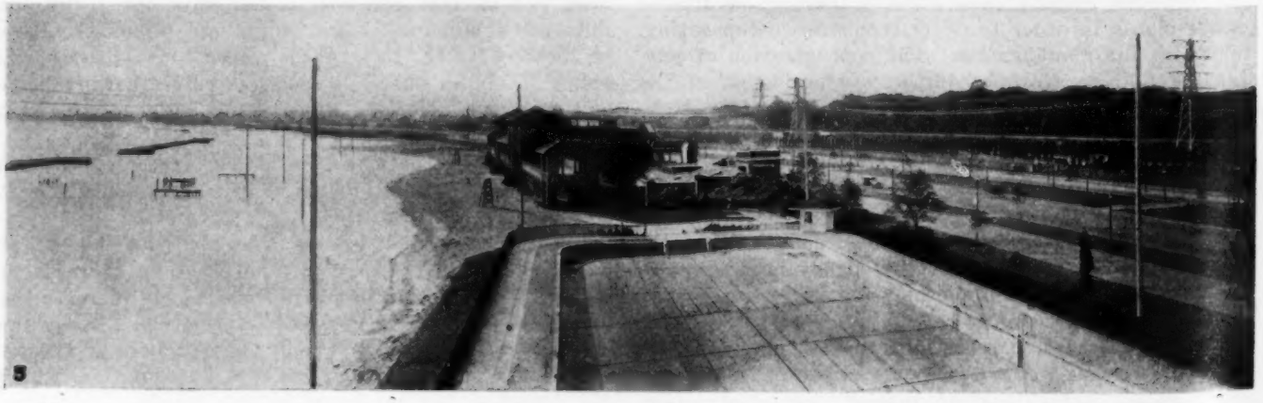
No. 2—Special tower base permitting two lines of traffic on roadway.

No. 3—Construction through exhibition park; two million persons entered this park in two weeks and very few noticed the line at all.

No. 4—Construction over a residence; no tenants have complained of any possible hazard.







Methods that Expedite Meter Work

System Used by the Dayton Power & Light Company to Maintain Information that Is Essential to Convenient Operation Without Involving Unnecessary Records

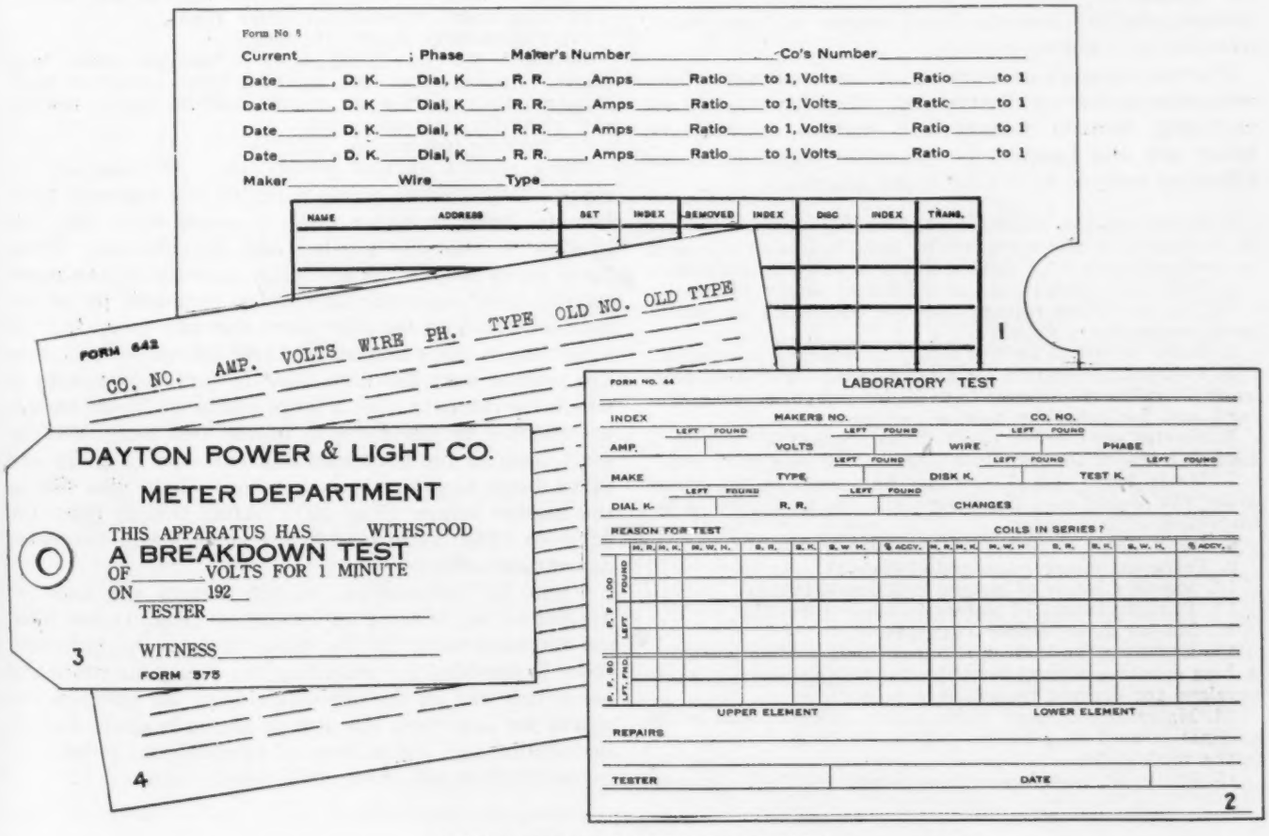
By KARL H. BAUSMAN

Supervisor of Meter Department, Dayton Power & Light Company, Dayton, Ohio

RECORD systems have acquired quite general ill repute due to few but flagrant applications or non-use involving red tape and clerical work not justified by the results obtained. However, any business that involves many functions cannot be economically, conveniently and safely conducted if routine information is carried only in the minds of the individuals and is permitted to follow them to their sick-beds or even to their graves.

Recognizing the objections that extreme systematization may have, the records of the meter department of the Dayton Power & Light Company have been revised and culled out from time to time until it is now believed that only such records remain as are absolutely essential to the conduct of the department and the company as a whole. In general, the records that are kept have the following purposes: (1) To indicate acceptability of new apparatus or suitability of any apparatus for operation; (2) to record stock on hand or installed; (3) to enable the most economical scheduling of work; (4) to afford instructions for carrying out work; (5) to permit following up work; (6) to indicate responsibility for work completed; (7) to show condition of equipment at specific times (such as meter accuracy necessary for company or public welfare); (8) to give history of equipment (location and performance); (9) to afford departmental heads and executives information regarding work done; (10) to permit accounting, billing and time analysis; (11) to enable analysis of past experience to guide future conduct; (12) to facilitate keeping the foregoing records. In general, the records have been made out and are so routed, filled in and filed that it is logical, convenient and time-saving to use them.

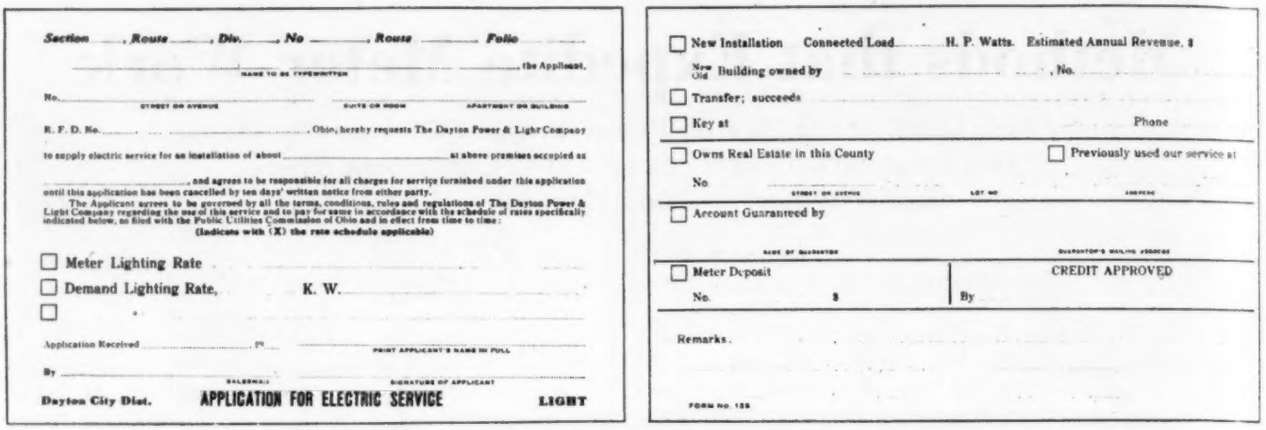
The increased floor space (1.82 sq.ft. per 100 meters installed) allotted the meter department and the excellent daylight and artificial lighting facilities afforded have greatly facilitated the work of the meter department and provided adequate space for the filing cabinets (one file for every 275 meters). Files are provided



FORMS USED IN RECORDING METER DATA

Fig. 1—Type of envelope for holding meter records. A card of same size and carrying same information is used as central record for meters issued to outlying districts.

Fig. 2—Laboratory test record for individual meters.
Fig. 3—Tag indicating voltage test has been made.
Fig. 4—Daily record of meters tested in laboratory.



Section ..., Route ..., Div. ..., No ..., Route ..., Folio ...

..., the Applicant,
NAME TO BE TYPEWRITTEN

No. ... STREET OR AVENUE ... DATE OR HOUSE ... APARTMENT OR BUILDING

R. F. D. No. ..., Ohio, hereby requests The Dayton Power & Light Company to supply electric service for an installation of about ... at above premises occupied as ...

..., and agrees to be responsible for all charges for service furnished under this application until this application has been cancelled by ten days' written notice from either party.

The Applicant agrees to be governed by all the terms, conditions, rules and regulations of The Dayton Power & Light Company regarding the use of this service and to pay for same in accordance with the schedule of rates specifically indicated below, as filed with the Public Utilities Commission of Ohio and in effect from time to time:

(Indicate with (X) the rate schedule applicable)

☐ Meter Lighting Rate ...

☐ Demand Lighting Rate, K. W. ...

☐ ...

Application Received ..., 19... PRINT APPLICANT'S NAME IN FULL ...

By ... SALESMAN ... SIGNATURE OF APPLICANT ...

Dayton City Dist. **APPLICATION FOR ELECTRIC SERVICE** LIGHT

☐ New Installation Connected Load ... H. P. Watts. Estimated Annual Revenue, $

New / Old Building owned by ..., No. ...

☐ Transfer; succeeds ...

☐ Key at ... Phone ...

☐ Owns Real Estate in this County ☐ Previously used our service at

No. ... STREET OR AVENUE ... LOT NO. ... ADDITION ...

☐ Account Guaranteed by ...

NAME OF GUARANTOR ... GUARANTOR'S MAILING ADDRESS

☐ Meter Deposit No. ... $ ... CREDIT APPROVED By ...

Remarks. ...

FORM NO. 138

FIG. 5—FORM OF APPLICATION FOR SERVICE. FOR LIGHT SERVICE IN DAYTON A WHITE CARD IS USED; FOR POWER SERVICE A BLUE CARD, AND FOR SUBURBAN LIGHT A BUFF CARD

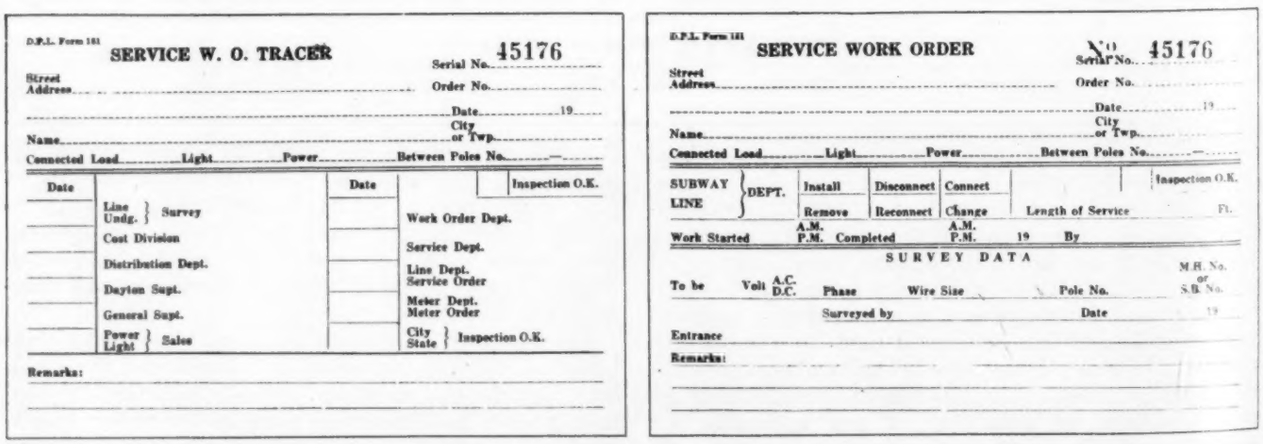
for records of equipment in stock, reserve or tickler records, district records, live records of equipment, installed and inactive records.

For the conduct of work involving customers' kilowatt-hour meters and instrument transformers, but not including demand meters and station instruments, which are also handled by the meter department, the following records have been found essential:

1. Envelopes for holding meter records (5x8). A card of the same size and carrying the same information is used as a central record for meters issued to outlying districts.
2. Laboratory test record of individual meters (4x6).
3. Tag indicating voltage test has been made on instrument transformers ($2\frac{3}{8}$x$4\frac{3}{8}$).
4. Daily record of meters tested in laboratory ($4\frac{1}{4}$x$6\frac{1}{2}$).
5. Form of application for service (4x6). For light service in Dayton a white card is used, for power service a blue card, and for suburban light a buff card.
6. Service work order (4x6). The original white copy is used as a tracer and duplicate salmon card as a work order.
7. Meter order ($4\frac{1}{4}$x$7\frac{1}{4}$). The first copy is the meter order, the second copy the tracer, and the third copy is the inspection or test order.
8. Daily meter stock report (11x$16\frac{1}{4}$).
9. Perpetual meter inventory ($11\frac{3}{4}$x$16\frac{3}{4}$).
10. Monthly ledger of meters installed ($9\frac{1}{4}$x$11\frac{3}{4}$).
11. Monthly ledger of meters in stock ($9\frac{1}{4}$x$11\frac{3}{4}$).
12. Master meter ledger ($9\frac{1}{4}$x$11\frac{3}{4}$).
13. Envelope for instrument transformer records (5x8). A blue envelope is used for potential transformers, a white envelope for current transformer records.
14. Meter department work order (3x5). The white original is used as a tracer and the duplicate salmon card is the work order.
15. Potential transformer test record ($4\frac{1}{2}$x$7\frac{1}{2}$). A similar card is used for keeping current transformer records.
16. Instrument transformer order (3x8).
17. Transformer ledger ($9\frac{1}{4}$x$11\frac{3}{4}$).
18. Cards for scheduling dates of periodic meter tests (3x5). Salmon cards are used for tests conducted every three months; blue for six months, buff for twelve months, and white for eighteen months.
19. Periodic test records ($4\frac{1}{2}$x$7\frac{1}{4}$).

Upon receipt of new meters they are badged with copper identification plates carrying the company number and hung on meter racks in consecutive order according to company number and classification. From these racks the meters are taken in order by the meter testers, who make the acceptance test and fill in the data indicated on the laboratory test slip (Fig. 2). To save time, a large number of these laboratory test slips are printed with the data filled in for those meters of which the company uses a large number. These records are checked by the foreman of the test room, who inserts them in the corresponding envelope (Fig. 1) and turns them over to a meter record clerk, who fills in the master ledger (Fig. 12). After this is done, the envelope (Fig. 1) is filed in the stock file in the meter department office.

From the information on the meters the data indicated in the heading of envelopes (Fig. 1) are filled out for each meter by the meter tester. As indicated, space is provided for recording the data four times and below this and on the opposite side of the envelope are spaces for seventeen changes in meter location, date of installation and index, date of removal and index, disconnected date and index, and transfer date.



D.P.L. Form 181

SERVICE W. O. TRACER Serial No. 45176

Street Address ... Order No. ...

... Date ... 19 ...

Name ... City or Twp. ...

Connected Load ... Light ... Power ... Between Poles No. ... — ...

Date		Date		Inspection O.K.
	Line Undg. } Survey		Work Order Dept.	
	Cost Division		Service Dept.	
	Distribution Dept.		Line Dept. Service Order	
	Dayton Supt.		Meter Dept. Meter Order	
	General Supt.		City State } Inspection O.K.	
	Power Light } Sales			

Remarks: ...

D.P.L. Form 181

SERVICE WORK ORDER No. Serial No. 45176

Street Address ... Order No. ...

... Date ... 19 ...

Name ... City or Twp. ...

Connected Load ... Light ... Power ... Between Poles No. ... — ...

SUBWAY LINE } DEPT.	Install	Disconnect	Connect		Inspection O.K.
	Remove	Reconnect	Change	Length of Service ... Ft.	

Work Started ... A.M. P.M. Completed ... A.M. P.M. 19 ... By ...

SURVEY DATA

To be ... Volt A.C. D.C. Phase ... Wire Size ... Pole No. ... M.H. No. or S.B. No.

Surveyed by ... Date ... 19 ...

Entrance ...

Remarks: ...

FIG. 6—SERVICE WORK ORDER. THE ORIGINAL (WHITE) COPY IS USED AS A TRACER AND THE DUPLICATE SALMON CARD AS A SURVEY OR SERVICE WORK ORDER

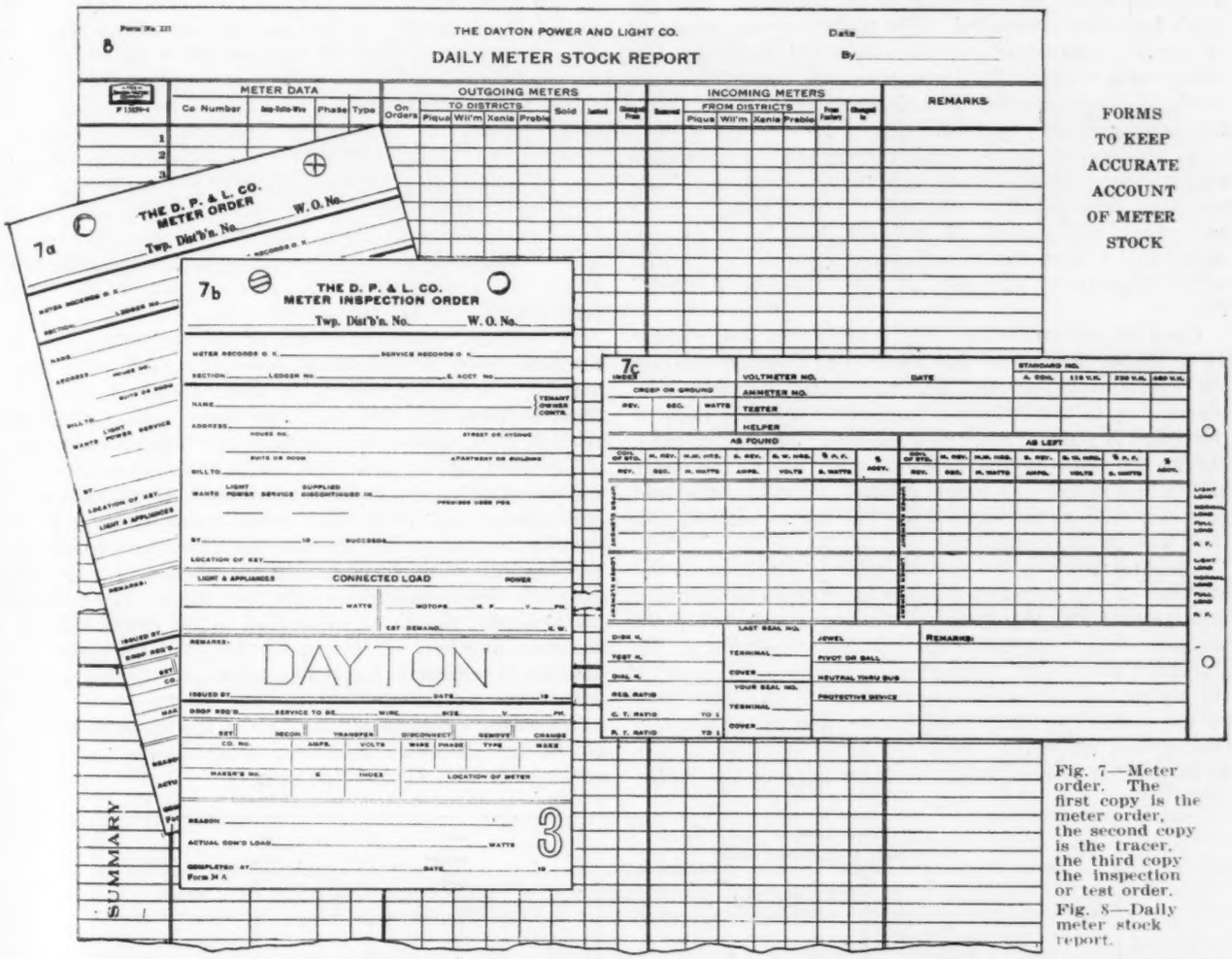
After the meters are tested, they are subjected to a breakdown test, and at the same time the daily record (Fig. 4) of meters tested in the test room is filled out to facilitate racking and inventory of meters. From the breakdown test the meters go to the tested stock rack, being grouped by the following classifications: single phase, polyphase, direct current, voltage, wire and ampere capacity.

Three forms for service application (Fig. 5) are employed, white cards being used for city light service, buff cars for suburban light service and blue cards for power service. The applications are filled in and signed at the application desk of the commercial department and delivered to the meter department. At the latter point the meter service clerk makes out, in duplicate, a service work order (Fig. 6), filling in the street address, name, date and connected load. These work orders are also made out on telephone inquiries from prospective customers and contractors without application. After this work has been completed, the original application (Fig. 5) is filed in the application file by name and the white tracer copy of the service work order (Fig. 6) is filed by street address to serve as a cross-check. The salmon copy of the service work order is sent to the survey section of the distribution department, at which point it becomes a service survey order.

Upon observation of conditions, the survey man fills in the data indicated on the salmon copy of the service survey order and returns it to the meter department, where it again becomes a service work order and is filed with the white copy. If no application has been received up to this time for a particular job, the service work orders are filed under "Pending Applications." Upon a receipt of an application for service, the service work order becomes a work order for the service crew.

When the application for service has been received, the meter service clerk makes out in triplicate, from the application and survey card, the meter order (Fig. 7), filling in all data required except the company number, maker's number, meter constant, index, type and make of meter. The meter record clerk then goes to the meter stock room window and withdraws the size and type of meter required, filling in on the meter order the company number, type, make, maker's number and constant on all copies except the first copy, on which the maker's number, type and dial constant are omitted. The first copy of the meter order and the salmon copy of the service work order (Fig. 6) are attached to the meter, which is hung on the outgoing rack according to the territory in which it is to be installed. The second and third copies of the meter order are held for purposes that will be explained later. The meter stock clerk enters data regarding incoming and outgoing meters on the daily meter stock report (Fig. 8). At the end of the day he summarizes from the same record all of the information according to the size of the meter. This summary is transferred to the perpetual meter inventory (Fig. 9), which is kept in the meter stock room.

The installation crew that installs the service and



FORMS TO KEEP ACCURATE ACCOUNT OF METER STOCK

Fig. 7—Meter order. The first copy is the meter order, the second copy is the tracer, the third copy the inspection or test order.

Fig. 8—Daily meter stock report.

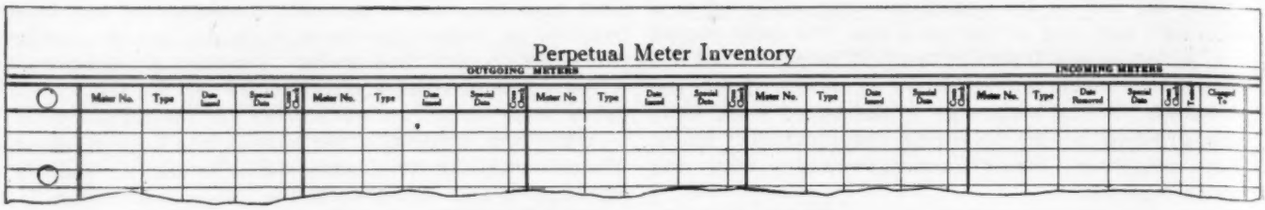


FIG. 9—PERPETUAL METER INVENTORY

meter fills in on the first copy of the meter order (attached to the meter) the maker's number, type, dial constant, checks company number and signs name, returning this order and the salmon copy of the service order (Fig. 6) to the meter service clerk as an indication that the work has been completed. The meter record clerk fills in the corresponding second and third copies of the meter order (Fig. 7) indicating who completed the work, the date completed, and also checks the maker's number, type and constant.

At the end of each month the second copies of the meter orders (Fig. 7) are sent to the consumers' accounting department to serve as a cross-check to make sure that the customer's account has been opened. After this is done the second copies are returned to the meter department and filed in the "Inactive Records" file.

Upon the return of the first copy of the meter order (Fig. 7) by the meter installer, it is checked against the application contract and the meter envelope corresponding to the company number on the first copy of the order is pulled from the stock file. The meter clerk checks the data on the envelope with the meter order and enters customer's name, address, date installed and index on the meter envelope. The meter envelope is then filed in the reserve file.

The first copy of the meter order is attached to the application and forwarded to the consumers' accounting department. The third copy of the meter order (Fig. 7) becomes either the meter installation inspection or installation test order, depending on the size and type of the meter. It is issued upon return of the first copy by the meter installer, being forwarded to the outside testing and inspection section. After installation test or inspection is completed the third copy of the meter order is checked and returned to the meter record clerk, who puts it in the corresponding envelope (Fig. 1), which is taken from the reserve file and placed in the live file.

The white copy of the service work order (Fig. 6) is pulled from the tickler file and placed in the inactive file. The salmon copy of the service work order, returned by the service crew upon completion of the work to the meter service clerk, is forwarded to the statistical department for time study and cost data analysis.

A master ledger (Fig. 12) is kept by the meter record clerk, being filled in for all new meters from the data on the envelope (Fig. 1) and for all old meters from periodic test. This ledger carries the price of meters and is kept in the meter department, affording a complete inventory of all meters owned by the company whether in Dayton or other districts.

A monthly record of installed meters (Fig. 10) is filled in from the perpetual inventory (Fig. 9). The monthly record of meters in stock (Fig. 11) is also filled in from the perpetual inventory. Both of these records go to the ledgers in the meter department office.

To avoid the red tape that would be entailed by keeping a central record of all meters issued to districts outside Dayton, a card similar to the envelope (Fig. 1) is kept in the central file for each meter so issued and the corresponding envelope and all records are kept in the districts where the meters are installed. The card is marked with the district and filed in the district file by company number. If the meter is sent back from the district in which it has been used, the corresponding envelope is returned with it. The card corresponding to the meter envelope is pulled from the district file and placed in the meter envelope, after which the meter envelope is filed in the stock file.

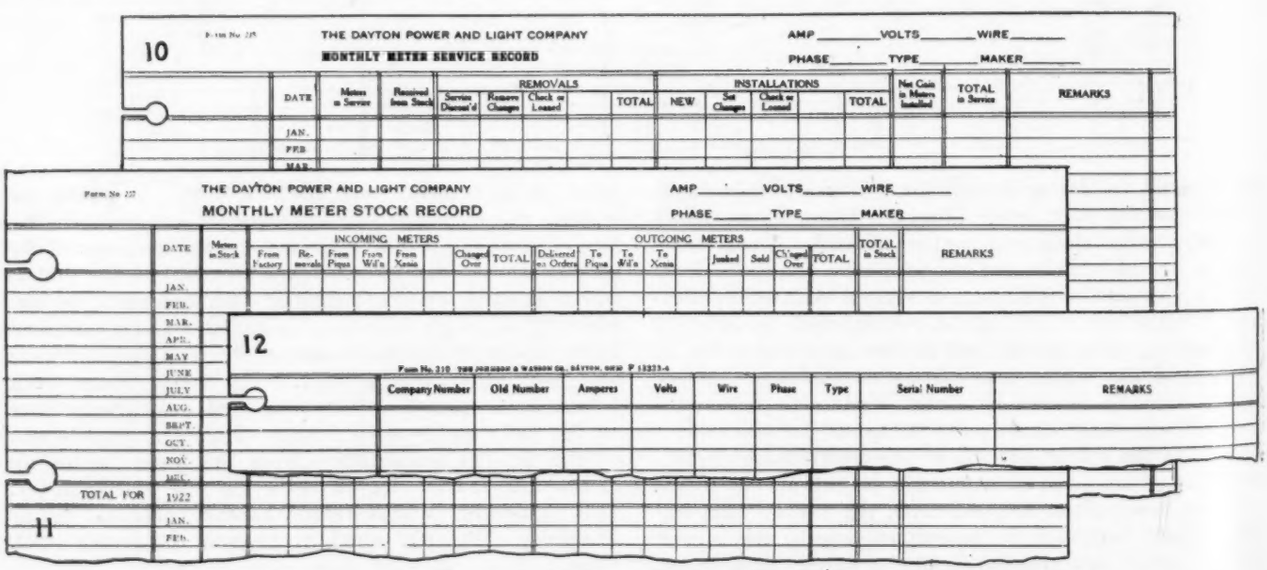
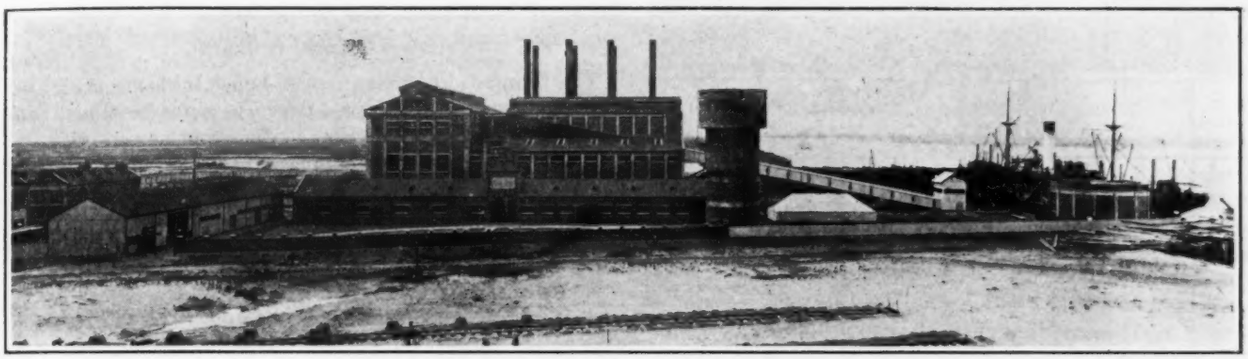


FIG. 10—MONTHLY LEDGER OF METERS INSTALLED. FIG. 11—MONTHLY LEDGER OF METERS IN STOCK. FIG. 12—MASTER LEDGER

New Australian Central Power House

Adelaide Electric Supply Company Builds Osborne Station and Transmission System to Supply Area Equal to that of England and Wales—First to Adopt Outdoor Switchgear—Original Construction Features

By F. W. H. WHEADON
Engineer and Manager Adelaide Electric Supply Company, Ltd.



NEW OSBORNE STATION WITH CONCRETE WATER TOWER IN FOREGROUND

AUSTRALIA, though as large as the United States, has a population which is less than one-twentieth that of the republic, and even this population is very largely contained in six large cities. It therefore goes without saying that Australia is far from being an industrialized country. The sparseness of its population and the great distance between its towns explains why in electrical development the island continent is, generally speaking, somewhat backward. But there seems an awakening just now, and transmission systems reaching from 100 to 150 miles are either under construction or will soon be so.

In connection with the use of electricity it might be said that there are high transportation charges and heavy customs duty on virtually all electrical machinery entering Australia from abroad, yet in spite of these handicaps the average price for energy sold by a company such as the Adelaide Electric Supply Company, Ltd., is 3.6 pence (about 7 cents) per kilowatt-hour. In connection with the domestic use of electricity it is almost the universal practice in Australia that such appliances as electric flatirons, washing machines, fans, etc., are connected to the power circuit and charged at the power rate. This means that nearly every house has two meters, one for lighting and one for domestic power, which renders it unnecessary to conduct expensive publicity campaigns in order to push this type of appliance. The importation of the more expensive electrically operated appliances, such as washing machines, vacuum cleaners and cooking stoves, is undoubtedly hampered by a heavy customs duty of approximately 45 per cent ad valorem, which makes the cost of these to the customer at least double the rate prevailing in America.

South Australian Development

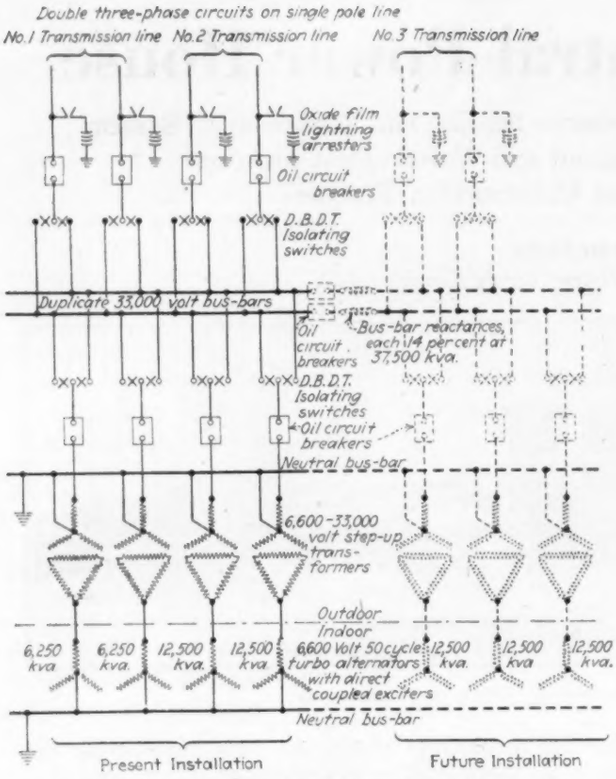
The development of the Adelaide Electric Supply Company, Ltd., in South Australia is remarkable. It started in 1898 with a capital of £30,000 and a small power station at Port Adelaide and has grown to have a capital of £2,500,000 and a power station with an ultimate capacity of 60,000 kw. Its distributing network has been laid in 650 miles of street, and it is serving 52,000 customers in the metropolitan area of Adelaide. The company's franchise enables it to transmit electrical energy throughout the State of South Australia, 380,000 square miles, of which only one-eighth—with an area roughly that of England and Wales—is closely settled. The company is now extending its system to rural districts well outside the metropolitan area, and a scheme for supplying one of these areas, mostly agricultural, 65 miles distant, is in progress. In addition a plan for the transmission and distribution of about 10,000 kw. at 110,000 volts for irrigation purposes in the Murray River Valley, 150 miles from Adelaide, is under consideration.

Since 1901 energy has been supplied from a power station in the city of Adelaide, but the business has outgrown that site, where there is a lack of adequate condensing water and coal transportation to which is expensive. For this reason the company in 1917 obtained a 22-acre water site at Osborne, 15 miles from Adelaide, on an estuary of the sea. This site, after reclamation—it was formerly swamp land—and the building of a wall provides facilities for the discharge of the largest colliers in the Australian coastal trade (7,000 tons), and an unlimited supply of sea water is available for condensing purposes.

Description of Structure

The site was low-lying and sandy and covered at high tide, and it was necessary to resort to both reclamation and piling for the foundation. More than four thousand hard-wood piles were driven to a depth of 35 ft., where they stand on a stiff stratum of clay and limestone. The site to be occupied by the power house was then reclaimed to a height of 4 ft. above the highest tide by dredging from the estuary for the wharf berth and the sea approaches thereto. In September, 1920, it was possible to start actual building foundations.

The general design of the power station is for the ultimate capacity already mentioned—60,000 kw. of



SINGLE-LINE DIAGRAM OF ELECTRICAL CONNECTIONS OF OSBORNE STATION

plant installed. The first section, which is now built, contains 30,000 kw. of generating plant and went into commercial operation on August 12, 1923. All coal for the station is shipped from Newcastle, New South Wales, a sea distance of 1,200 miles. The coal has a calorific value of 12,000 B.t.u. to 13,000 B.t.u., and its present cost is 36 shillings per ton delivered in 5,000-ton to 6,000-ton cargoes at the company's wharf.

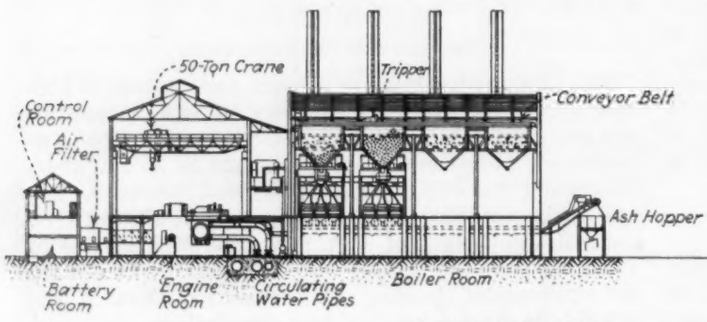
One of the interesting features of the station is that the sandy nature of the ground made it impossible to excavate for low-level circulating-water ducts direct from the river to the engine room; consequently a pumping chamber was built as close to the river as possible and the water pumped from it to the engine room through high-level ducts. The pumping chamber stands on a reinforced-concrete caisson of 61 ft. outside diameter by 45 ft. deep with walls 2 ft. thick. For the ultimate development of the station the circulating system was designed to have a water velocity through the ducts of 5.5 ft. per minute. The ducts are made of reinforced-concrete pipe of large size and handle a head of circulating water of 35 ft. The pipes are 5 ft. in internal diameter and were made by the centrifugal process. They have a wall thickness of 3 in. heavily reinforced and are made up in 8-ft. lengths each weighing about 3 tons. The joints are made with concrete collars calked with a bitumin and neat cement filling. Two lines of pipe are laid and rest for their entire length upon a reinforced-concrete mat placed 8 ft. below the reclaimed site level and supported on piles at 4-ft. intervals. In twelve months of operation there has not been any leakage either in the pipes or the joints. The route length of the circulating system from inlet to discharge is 1,300 ft., with a 500-ft. distance along the river front from inlet to discharge.

POWER-HOUSE BUILDING

The foundations of the power-house building are built upon substantial reinforced-concrete slabs resting upon nests of piles driven at 4-ft. centers and sawed off 3 ft. 6 in. below reclaimed level. The superstructure is of reinforced-concrete rectangular columns spaced at approximately 12-ft. centers, the panels being filled with 9-in. brick laid in cement. The first section of the engine room as now built is for one-half the designed ultimate capacity of the station and is 192 ft. long, 70 ft. wide and 56 ft. from basement to crane rail. The engine and boiler room each have a 21-ft. basement, and the ultimate length of the engine room will be 315 ft. A 50-ton overhead electric crane is installed in the engine room. The circulating-pump room is a circular brick and concrete building, 60 ft. in diameter by 18 ft. to roof, standing upon the reinforced-concrete caisson referred to previously. It has been designed for six vertical centrifugal pumps, each of 1,000,000 gal. per hour capacity. The pumps are set slightly above the floor of the caisson, and their suctions connect to an inner circular chamber forming the intake from the river. The motors and operating switchgear are placed at the reclaimed level of the site, the 25.5 ft. of vertical shafting between motors and pumps being securely held from whipping by vertical bearings supported on heavy steel columns carried up from caisson floor to ground floor. The motors with their pumps are set out in radial formation, and provision has been made vertically over each motor for withdrawing both pumps and motors for repairs. The motors are 250-r.p.m., 440-volt direct-current units with an over-all efficiency of 78 per cent.

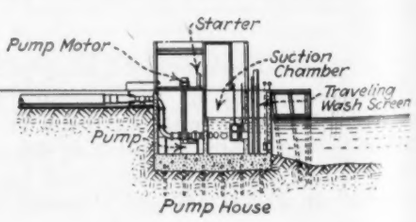
ENGINE-ROOM CONSTRUCTION

The engine room is a plain substantial brick and concrete structure, 70 ft. wide by 192 ft. long by 93 ft. high from basement to the roof-ridge capping. A feed-water tank, feed pump and distilling annex adjoin it on the eastern side. The boiler house bays lead off at right angles to the engine room. Owing to the good lighting in Australia fewer windows are used than is



Sectional Elevation

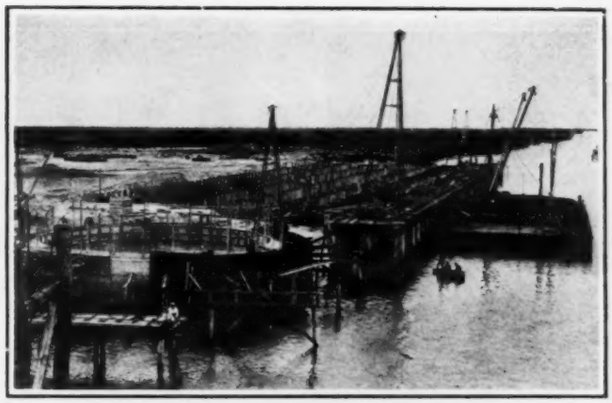
SECTION OF OSBORNE STATION, SHOWING DETAILS OF LIFT USED ON CIRCULATING WATER



common in American and English practice, but, on the other hand, a slightly higher and better ventilated roof has been adopted. In the engine room the following equipment is installed at present: (1) A 5,000-kw., twelve-stage, 3,000-r.p.m., 6,600-volt, three-phase, 50-cycle Metropolitan-Vickers turbo-alternator with spring-supported surface condensers having 10,000 sq.ft. of cooling surface with two passes for the circulating water, equipped with an integral feed heater and a Le Blanc air and condensate pump by the same maker; (2) a 5,000-kw., ten-stage, 3,000-r.p.m., 6,600-volt, three-phase, 50-cycle British Thomson-Houston turbo-generator with surface condenser having 9,000 sq.ft. of cooling surface and two passes for the circulating water with a kinetic rotary, air and condensate pump by W. H. Allen & Sons; (3) a 10,000-kw., twelve-stage, 3,000-r.p.m., 6,600-volt, three-phase, 50-cycle Metropolitan-Vickers turbo-alternator with spring-supported surface condenser having 20,000 sq.ft. of cooling surface and two passes for the circulating water, equipped with integral feed heaters and Le Blanc air and condensate pumps by the same maker; (4) a 10,000-kw., nine-stage Fraser & Chalmers turbine, directly connected to 4,000-r.p.m., 6,600-volt, three-phase, 50-cycle alternator made by the British General Electric Company, with a spring-supported surface condenser having 17,000 sq.ft. of cooling surface and two passes for circulating water, equipped with a Breguet "Ejectair" and condenser pump by Hicks, Hargreave & Company.

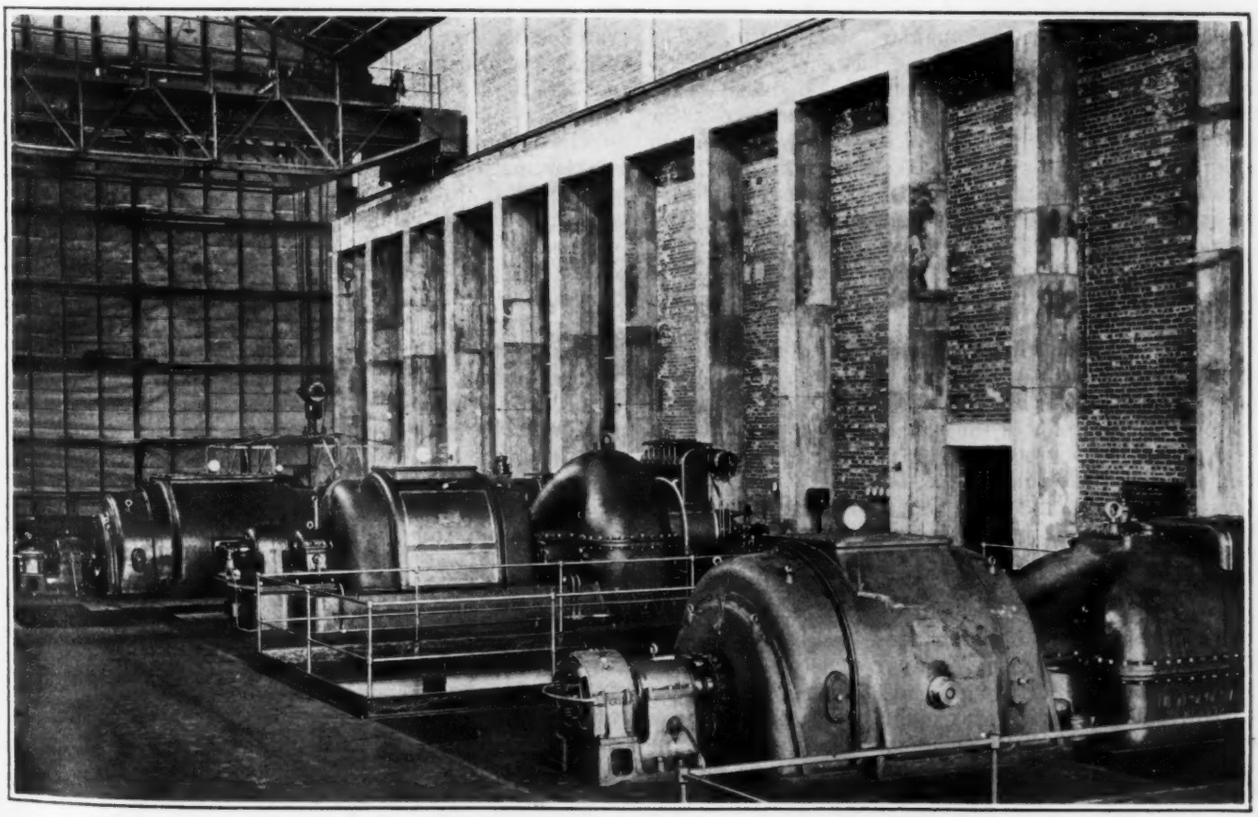
These sets are carried on substantial concrete foundations resting upon 35-ft. piles driven at 3-ft. and 4-ft. centers. A feature of the foundation structure of each unit is its complete isolation both from the building and the floors.

All the station auxiliaries, with the single exception of boiler-feed pumps, are electrically operated at 440 volts direct current, and to provide power for these a 500-kw. direct-current Parsons-geared turbo-generator, 440 volts, 6,000/750 r.p.m., has been installed. For light loads and as a spare one 500-kw. motor-generator set is used, taking energy from the 33,000-volt busbars through a station transformer and converting it to 440-volt direct current. Both these sets and the direct-current switchboard controlling them are erected and placed at about the future mid-length of the engine room.

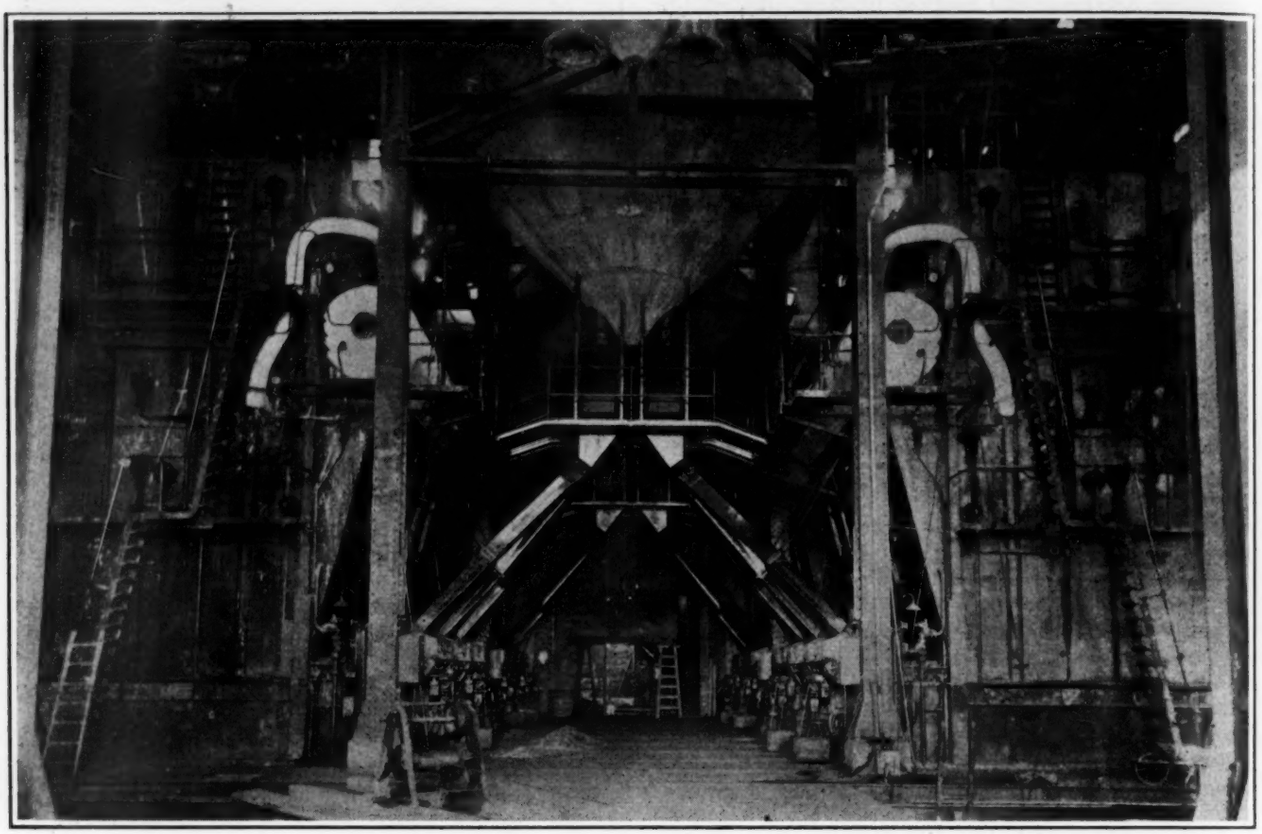


WHARF PILING AND CONCRETE CAISSON FOR CIRCULATING WATER

All the turbines are designed for operation with steam at 250 lb. superheated at 200 deg. F., giving a total temperature of 606 deg. F. and a vacuum of 28½ in. when supplied with circulating water at 70 deg. F. The full-load steam guarantees for the 5,000-kw. sets are 11.2 lb. per kilowatt-hour and for the 10,000-kw. sets 10.93 lb. per kilowatt-hour. All the steam and water pipes are placed in the basement, and



ENGINE ROOM CONTAINS TWO 5,000-KW. UNITS AND TWO 10,000-KW. UNITS



BOILER HOUSE HAS REINFORCED-CONCRETE CIRCULAR BUNKERS, AUTOMATIC WEIGHERS AND ECONOMIZERS

the air for cooling the units is passed through Sturtevant wet-air filters placed on the western side of the building, the air being led into the base of the generator foundations through rectangular steel ducts. The British General Electric machine has a closed air system. In the engine-room annex are installed three 15,000-gal. feed-water pumps with overhead feed-water storage and distilling tanks. All the feed water used in boiler make-up is distilled in Weir evaporators. The exhaust steam from the low-pressure stages of the unit raises the condensate to a temperature of 150 deg. to 160 deg. F., after which it is delivered to a feed tank.

Owing to the use of steel economizer tubes, it is essential that the oxygen content of the condensate shall be reduced to less than 0.5 cu.cm. per liter. This is done by the simple expedient of suspending a number of short ends of boiler tubes in the feed-water tank and daily cleaning off the deposit of black oxide which forms on them. This reduces the original oxygen content of 5 cu.cm. to 6 cu.cm. to the required limit. The comparatively high temperature of the condensate at this point considerably hastens the action, and daily tests show 0.1 cu.cm. to 0.2 cu.cm. per liter of oxygen in the condensate after treatment.

CONSTRUCTION OF BOILER HOUSE

The first of three similar boiler-house bays placed at right angles to the engine room is completed. Each bay is 92 ft. long by 130 ft. wide and 85 ft. from basement to roof, and it provides for eight boilers in two lines with a central aisle between them. The installment in the first bay consists of eight cross-drum-type marine B. & W. boilers, each having 6,121 sq.ft. heating surface and 1,797 sq.ft. superheater surface. In four of the boilers there are steel economizers of 4,800 sq.ft. heating surface, and in the other four similar economizers, but of the Greene cast-iron tri-tube type with the same heating surface. They are designed to evaporate 42,000 lb. of water per hour from and at 212 deg. F. when supplied with coal of 12,000 B.t.u. and to convert it into steam at 275 lb. per square inch with a superheat of 200 deg. F.

The boilers are equipped with B. & W. chain-grate stokers, each having an area of 231 ft. The furnaces are set 4 ft. higher than the maker's usual standard, giving a furnace volume of 0.377 cu.ft. per square foot of heating surface. Each boiler has its own induced-draft fan and chimney, and provision has been made for operating the balance draft later or, if occasion requires, with oil fuel. The fans are placed on a platform over the boilers and are electrically operated with remote control. The self-promoting steel chimneys are 5 ft. 6 in. in diameter, 70 ft. high, giving a total height of 180 ft. above the boiler-room floor. Coal is supplied to the stoker hoppers from overhead bunkers situated in the aisle between the boilers. Each bunker carries the quantity of coal required by each boiler over twenty-four hours at full load. The ash from the grate discharges into water-immersed cast-steel-plate ash conveyors of the Underfeed Stoker Company's design situated in the boiler basement. There are two of these, each 145 ft. long, operated by 3-hp. motors driving the chain at a speed of 14 ft. per minute. The ashes are continually dropped through water-sealed chutes into these conveyors, where they are immediately quenched, and are conveyed to steel hoppers with Bartlett discharge valves placed outside the boiler house. From these the ashes are dropped into small tip-trucks and run out on the ash dump. A reserve reinforced-concrete water tower, 37 ft. in diameter by 80 ft. high,

Barometric Index Numbers

has been built. It has a capacity of 100,000 gal. of fresh water in the top tank and 50,000 gal. of sea water for quenching ashes, etc., in the lower section.

The switch house is situated at about the ultimate mid-length of the engine room and at a clear distance of 15 ft. from it on the western side. The 33,000-volt switchgear and transformers are of the outdoor type, this being the first station in Australia to adopt this particular type on a large scale. The switch house occupies a floor space of 125 ft. by 75 ft. immediately adjacent to the control room, which overlooks the whole of the switch yard. A reserve storage battery for control is available in the basement of the control room.

Each generator is connected solidly without switches to its individual bank of three 6,600-volt to 33,000-volt, single-phase, delta-star, step-up water-cooled transformers—the generator and its transformer being treated as a unit for the purposes of switching and relay operation. The star points of each generator are brought out through current transformers and solidly grounded. The neutral of the star side of the 33,000-volt step-up transformer is similarly grounded.

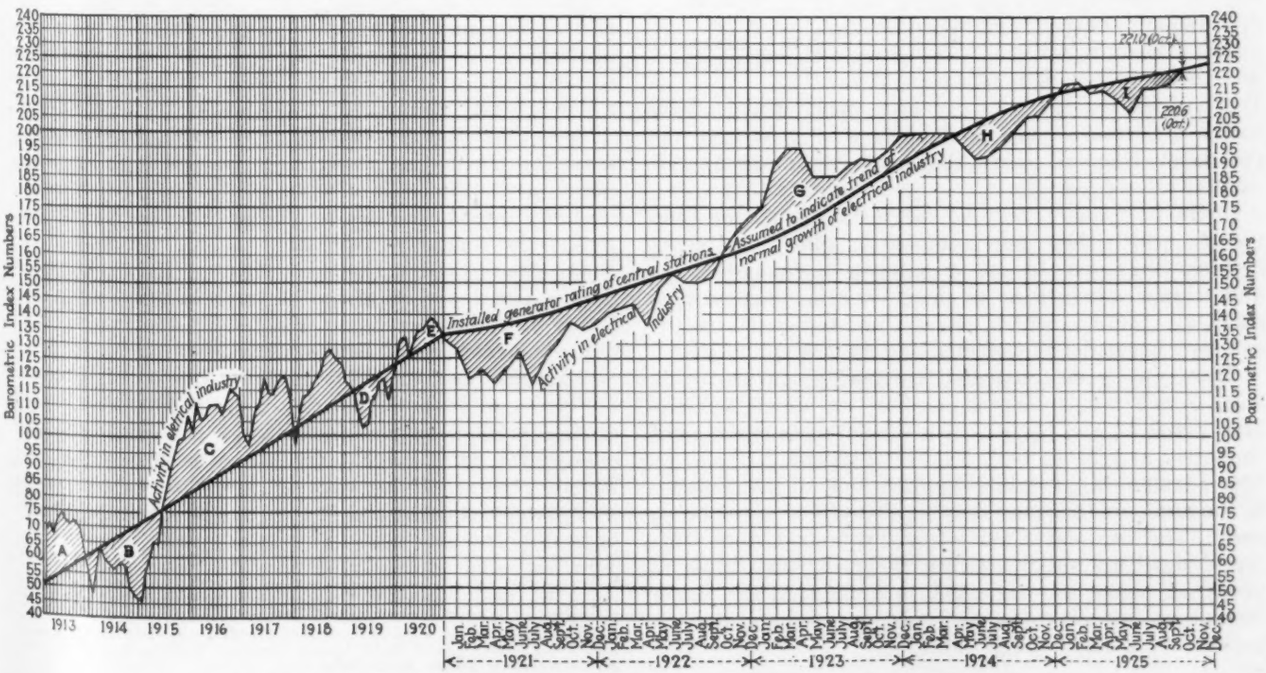
Duplicate 33,000-volt busbars carried on insulators supported on a pipework-frame structure are provided with double-throw selector switches. The outdoor switches are all of a uniform type and size, being solenoid-operated and having a carrying capacity of 440 amp. and a rupturing capacity of 250,000 kva. These are fitted with bushing-type current transformers for the operation of ammeters and protective relays. For lightning protection two banks of three-phase outdoor oxide-film lightning arresters are used at the power-station end of the two overhead transmission lines. In order to avoid switching complications, the usual 6,600-volt busbar has been omitted, and all supplies, both for local and distant requirements, are taken from the 33,000-volt bus.

The new station has been in operation less than twelve months, and only a portion of the company's system has been transferred to it, but during the last three months the following figures are typical: Station-plant factor, 52; water per kilowatt-hour generated, 14.50 gal.; coal per kilowatt-hour generated, 1.70 lb.; boiler-house efficiency, 76 per cent; station thermal efficiency, 14.30 per cent; load factor (three months' basis), 50.75 per cent; maximum load, 9,000 kw. The design of the station and its entire erection were carried out by the company's engineering staff, and the relative cost of the major items of the station for the 30,000 kw. of plant installed in percentage is as follows: Land and wharf, 5.56; building and piling, 28.80; boilers and steam pipes, 26.40; generating plant, 22.42; circulating-water system, 5.47; switch house, switchgear transformers, batteries, etc., 5.24; coal-handling gear, conveyors, etc., 4.70; sundries, 1.41. Items 1, 2, 5 and 7 provide for a maximum demand of 60,000 kw. and the others for 30,000 kw.

Industrial Activity Returns to Normal

AFTER seven months of subnormal activity, reaching its peak in the month of June, the activities of the electrical industry taken as a whole returned to normal during October. Production figures upon which is based the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" indicate that October witnessed a decided upward trend in the activities of the industry. The trend in general business during the past two months has been very satisfactory, and there appears to be every expectation that the volume of trade during the coming months will be the largest the country has ever experienced. That this general prosperity will extend to the electrical industry in all its branches there can be no doubt.

During October the electrical industry as a whole was operating at 0.4 per cent below the estimated normal for the month. In September it was operated at 4.2 per cent (revised) and in August at 5.6 per cent below normal. Incomplete returns indicate that the electric light and power branch of the industry continued its upward swing, which started in June, and was operating at 6.5 per cent above normal during October.



ACTIVITY IN THE ELECTRICAL INDUSTRY IS NOW ALMOST THE ESTIMATED NORMAL

Analysis of High-Tension Cables

Study of Dielectric Field of Cables—The Höchstädter Design Details—Experimental Work Carried On—Discussion on Dielectrics

By DR. K. KONSTANTINOWSKY
University of Vienna, Austria
Cable Manufacturing Company, Bratislava, Czechoslovakia

IT IS a well-known fact that in order to understand thoroughly the construction of high-tension cable the study of the electrostatic field in the cross-section of a cable is of great importance. Various articles have been written on this subject, dealing with it from a theoretical as well as from the experimental side. It seems, however, that no practical experiments have yet been carried out to demonstrate in front of an audience in a simple and convincing way what happens and what can happen when a voltage is put across the conductors of a high-tension cable. Though the writer, during the course of a lecture delivered at Prague[1] on March 27, 1924, carried out such experiments, their results have not become generally known. It can therefore be surmised that a brief description of these experiments will be of some interest, especially as, while easy to carry out, they will by their simplicity be readily grasped by an audience.

In plotting the losses that occur when charging a high-tension cable with alternating current or, better, cos φ against the voltage across the conductors, two different types of curve can result.

With one type of cable, cos φ remains constant or at least rises slowly and steadily as the voltage increases. With another type of cable the curve will at first remain constant or almost constant up to a certain voltage, after which it will suddenly rise at a fairly rapid rate. This sudden rise of cos φ can be attributed to changes in the dielectric of the cable. We shall now take the two most frequent cases that are attributed to this sudden rise of cos φ.

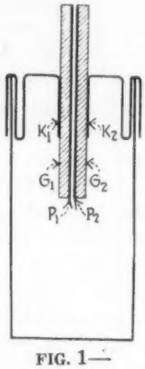


FIG. 1—INFLUENCE OF AIR POCKETS ON CABLE BEHAVIOR

In the first case it may be due to the insulating compound, which has not completely filled the space between the paper layers or between the paper layers and copper conductors or lead sheath, thus leaving small air pockets, which, though not noticeable to the eye, are nevertheless detected by the cos φ curve.

This can be demonstrated by taking, as shown in Fig. 1, two metal disks K_1 and K_2 on which Bakelite fiber plates G_1 and G_2 are stuck. The inside surfaces of the latter are coated with a layer of paraffin, P_1 and P_2. The paraffin is so thinly applied that it is invisible to the audience, only the brown color of the paper being seen. The two plates are set slightly apart, thus leaving a small air space between them. These plates of prepared paper are intended to represent the paper insulation, whereas the air space represents the air pockets in a badly filled cable.

If a voltage is applied between the two metal plates, the ensuing dielectric field across the air space is three or four times stronger than that across the paper plates. At the same time the hard paper possesses greater dielectric strength than air, and if the voltage is increased, the air insulation will break down long before that of the hard paper, resulting in much sparking across the air space. These sparks, which may be seen in the dark, heat up the paraffin layers, causing them to run and form a blot on the lower part of the plates. This, when cool, is of a white color and visible at a long distance. (Fig. 2.) This sparking causes an additional loss of energy to the normal dielectric loss due to charging; and thus a rapid rise takes place in cos φ above that value of the voltage where sparking commences.

Experiments have shown that this phenomenon, known as ionization, can be avoided if proper and suitable methods are applied during manufacture. Although in the case of single conductor cables these defects are more easily avoided owing to the fact that their paper insulation as a rule is thinner, they are difficult to eliminate between insulation and lead sheath in three-core cables.

It is believed by some that even if the cable is perfect when leaving the works such air bubbles can be formed during use owing to the lead sheath expanding beyond its limits of elasticity and not contracting when cool to its original size.[2] However, this statement is opposed by others, who base their opinions on the results of their own experiments.[3] In a further paragraph a cable will be discussed the construction of which entirely eliminates ionization at the lead sheath.

The other case of sudden rise of cos φ, shown in the following schematical experiment deals with three-phase cable only. Fig. 3 is a cross-section of such a high-tension three-phase cable in which C denotes its conductors, I the conductor insulation, B the belt insulation, F the fillers, and φ the lead sheath. Let us suppose that C and I are composed of impregnated paper, the layers of this paper being denoted by the rings. The fillers can consist of impregnated jute or of impregnated paper and therefore need no special distinction.

Figs. 4 to 7 show the electric field of such a cable during a whole cycle, each figure showing the field one-twelfth of a cycle later than the preceding one. Fig. 4 represents the lines of stress when conductor 1 is at zero, conductor 2 at 0.87 positive voltage amplitude and conductor 3 at 0.87 negative voltage amplitude.

[1] *Elektrotechnicky Obzor*, 1924, page 637.

[2] Since the lecture took place a new construction has been published by Pirelli which is also claimed to avoid these defects. ELECTRICAL WORLD, Vol. 85, page 603.

[3] Constructions et exploitation des grandes réseaux de transport d'energie éléctrique à très haute tension, Union des Syndicats de l'électricité, Paris, 1922, 706.

[3] van Staveren, E. T. Z. 1924, 161.

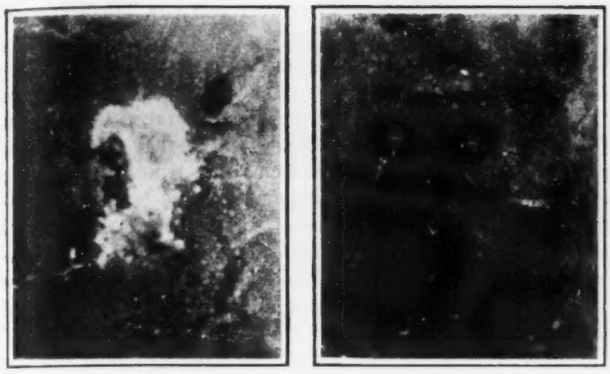


FIG. 2—BLOTS ARE FORMED BY SPARKING ACTIONS CAUSING IONIZATION

Fig. 5 shows the same as Fig. 4, but one-twelfth period later, conductors 1 and 2 at one-half positive phase voltage amplitude, whereas 3 has the full negative phase voltage amplitude and so on.

If we follow the direction of the field at a certain point, say at *P*, it will be noticed that at first the lines are almost perpendicular. In the next one-twelfth period they turn toward the left, in the following one-twelfth period they become almost horizontal. Continuing the period, the direction of the field turns clockwise, and finally, at the end of the full period, is again in its original state.

The direction of the field at point *P* has therefore turned 360 deg. clockwise during the course of one period. A similar state of affairs occurs at point *Q*, the only difference being that the field moves in an anti-clockwise direction.

If we study the field more closely, it will be noticed that, with the exception of certain lines, there is a turning field between conductors in one direction and between conductors and lead sheath in the reverse direction. This effect can be demonstrated by the following experiment:

In Fig. 8, *A*, *B* and *C* represent three brass cylinders, which in their turn represent the three conductors of a three-phase cable, and *z* is an iron ring representing the lead sheath, held in position by four ebonite supports *S*. *P* is a cylinder made of a stiff tissue paper suspended on a needle and free to rotate. If the paper cylinder is placed in between the brass cylinders and a three-phase voltage is applied between these three cylinders, the paper will begin to rotate in accordance with the rotating field.[4] In order to make it more visible from a distance it is advisable to have the paper cylinder colored with strips of various shades. If, on the other hand, the paper cylinder is placed between the brass cylinders and the iron ring, it will also rotate, but in the opposite direction.

The exact calculation, according to the method of Thomson's images, also goes to show that the rotating field, except at the middle point, is more or less elliptical—that is to say, that not all directions of field lines are obtained with the same strength of field, so that certain directions are obtained when the field is at its minimum and the others, nearly at right angles, when the field is at its maximum. This can also be demonstrated experimentally in the following manner:

A paper strip is balanced on a steel needle, which is also free to rotate but which offers at the same time a certain amount of friction. Now, if the paper strip is brought within our cable field and it is placed in such a position that the field is circular, then an equal pull will be exerted in all directions and the strip will remain stationary. If, however, it is placed in on a

[4] See Lampa, Weihselstromversuche, Vieweg, Braunschweig, Germany, 1911, 167.

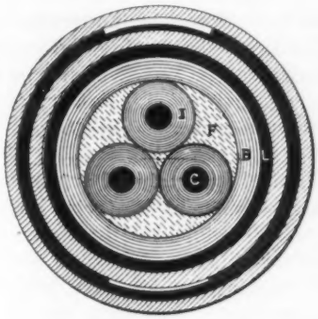


FIG. 3

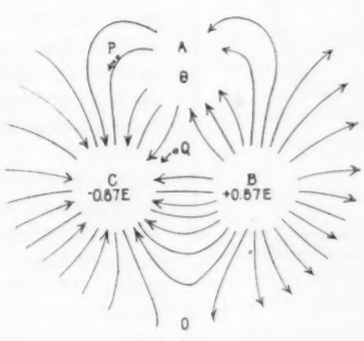


FIG. 4

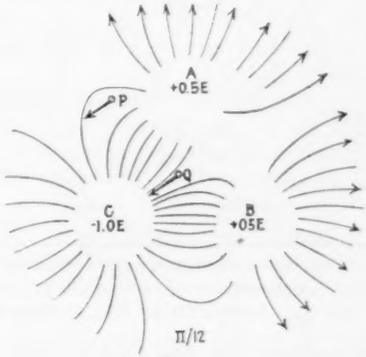


FIG. 5

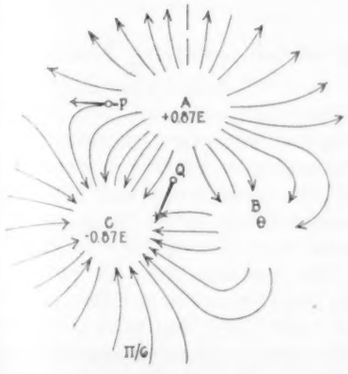


FIG. 6

FIG. 3—CROSS-SECTION OF HIGH-TENSION CABLE

FIGS. 4 TO 7—DIELECTRIC FIELDS OF CABLE SHOWN IN FIG. 3

Each figure shows the field in successive periods of 1/12 cycle starting when stress in conductor one is zero.

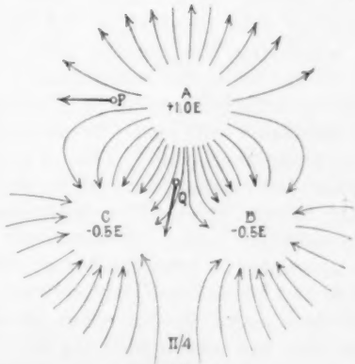


FIG. 7

point where the field is elliptical, then it will move and will take up a position pointing in the direction of the greater axis of the ellipse. The practical applications that can be derived from this are simple. It is a well-known fact that the dielectric strength of laminated insulating materials such as the impregnated paper of a cable is several times greater against the grain than with the grain. Taking again the point at *P* as

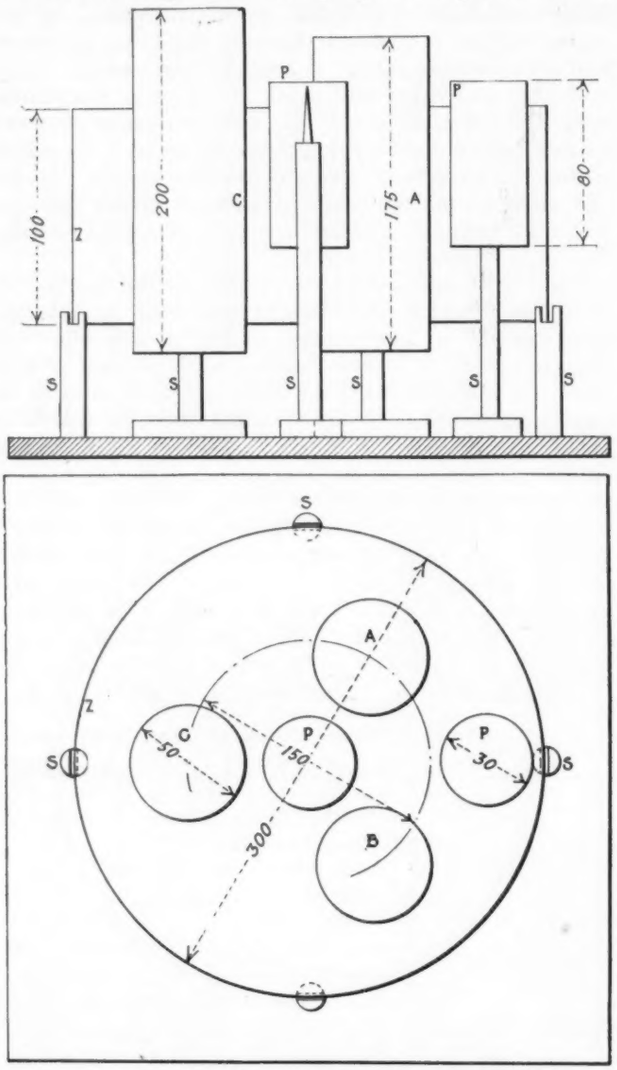


FIG. 8—A TURNING FIELD IS BETWEEN CONDUCTORS IN ONE DIRECTION AND BETWEEN CONDUCTORS AND SHEATH IN THE REVERSE DIRECTION

an example, we find that in only two moments during one period the direction of the field is at right angles to the grain; at all other times there exists a component of field strength in the direction of the layers. By increasing the voltage between the three conductors of the cable the component in the direction of the layers gradually steps up until it reaches a point where the insulation will partly break down, and a spark will occur along the layers. This is especially likely to take place in the triangle formed by the three conductors or in the filling between two conductors. For this reason more effective energy is consumed from a certain voltage upward, and thus the cos φ begins to rise.

The two phenomena demonstrated in the experiments described above do not occur with a single-conductor cable that has been made with due care, and, to a certain extent, this is indirectly one of the reasons for which single-conductor cables are used for the transmission of higher voltages. Although offering this advantage, the single-conductor cable system also presents disadvantages over the three-phase cable, for, owing to the hysteresis loss, it cannot be armored and must therefore be laid inside ducts. This reduces the cooling capacity of the cable and at the same time its carrying capacity.[5] There are also cases where the balancing currents in the lead sheaths give rise to additional copper losses of appreciable value. A type of three-phase cable having at the same time all the advantages of the single-conductor cable is found in the so-called Höchstädter cable.

The difference between the Höchstädter cable and the ordinary three-phase cable is that the belt insulation is entirely omitted, and the conductor insulation, the thickness of which is increased by an equivalent amount, is covered with a layer of metallic paper. The result is that under a common lead sheath we have really three single-conductor cables, thus eliminating the rotating electrostatic field with all its drawbacks, and the lines of force are always at right angles to the paper layers. In addition, the cable can be armored and the lead sheath losses are reduced to a minimum. With regard to the cooling effects, there again a great advantage is gained, as the metallic covers act as if they were cooling surfaces, especially so for the center triangle, which in the case of the three-phase cable is subjected to the greatest heat as well as to the strongest rotating field.

Finally, another advantage which the Höchstädter cable has over the ordinary single-conductor and the three-phase cable is well worth mentioning. The paper, having a metallized surface, is of the same composition as the rest of the insulation. This metal film now acts as the closing zero potential surface instead of the lead sheath, as formerly, and as the metallized paper has the same thermal expansivity as the rest of the paper insulation, it expands and contracts equally with the latter. From this it will be understood that, should the lead sheath, through heating, be expanded beyond its limits of elasticity, or should it not be made so that it lies tightly against the insulation, any air bubbles that might be formed thereby are of no consequence.

In a previous paragraph it was pointed out that when dealing with a laminated insulating material, as in the case of a three-phase cable, the field will collapse if the tension along the layers is increased beyond a certain point. The theoretical calculations, however, are always based on a homogeneous body, and this may be the reason theoretical breakdown calculations do not agree with results from practical tests.

France's Largest Generating Station

ACCORDING to the recently issued annual report of the Société de l'Union d'Electricité, the sixteenth turbo-generator set, rated at 40,000 kw., is operating at the Gennevilliers station and work is proceeding on the installation of the seventeenth and eighteenth units, which when completed will bring the capacity of the station up to no less than 340,000 kw. In addition the Vitry station of the company has an output of 90,000 kw. It has been found possible to close down the old station at Asnières, near Paris, but that at Puteaux is being retained for the present as an emergency plant.

[5]This only applies to the system customary in Europe.

More Wattage in the Home Lights

Exclusive of Attic, Closets, Exterior and Garage the Average Home Uses Twenty-two Lamps with Connected Watt Load of 958—Influence of Lamp Renewal Policies Noticeable

By M. LUCKIESH
Director Lighting Research Laboratory, Nela Park

WATTAGES of electric filament lamps in the home are of primary interest from the viewpoints of adequate illumination and central-station revenue. Without a detailed knowledge of the wattages of lamps in the lighting equipment in various rooms the commercial departments must operate blindly in attempting to bring better lighting into the home, and in return, to increase the revenue from energy consumption. Until recent years we had little or no data upon which to plan campaigns; however, two extensive surveys[1] have provided an intimate view of the present conditions. The first survey has proved of great value in planning and in stimulating campaigns, and progressive commercial departments have made much use of it. With the growing interest in residence lighting, it is certain that the more recent survey will prove very useful. Some of the data pertaining to lamp wattages were not included in the original report and are presented here. Other details may be found in the reports referred to.

Distribution of Lamp Wattages in Homes

The average number of lamps (bulbs) of various wattages per hundred homes is indicated in Fig. 1 for ceiling fixtures, portable lamps and wall brackets. These are the averages obtained from a survey of 7,000 homes. (Incidentally it has been found that only a few hundred homes, chosen at random, need to be surveyed in any place to give a very accurate view of the conditions). The dominance of the 25-watt, 40-watt and 50-watt lamps is obvious.

The average connected loads or wattages in lamps (bulbs) in different types of lighting equipment in various rooms are presented in Table I. Such data are worthy of considerable study. For example, an average of only 12 watts per home exists in the wall brackets in kitchens. Of course, this means that only a relatively few kitchens have a wall bracket. Actually only about one out of every four kitchens has one; still there should be one in each kitchen over the sink at least, containing a 40 or 50-watt lamp. Here, then, is a place to increase connected load by 28 or 38 watts. In a previous article it is seen that such an increase in an active socket very greatly increases the net revenue. An average of only 88 watts is found in the portable lamps in the living room and of only 164 watts in portables in the entire home. Inasmuch as there is an average of 2.8 portables per home, it is seen that the average per portable is 59 watts. Considering that we recommend eight portables for the conservative ideal, it is seen that here is a great opportunity for increasing connected load. Likewise the basement is very low in lamp-wattage. Thus one may proceed throughout the table.

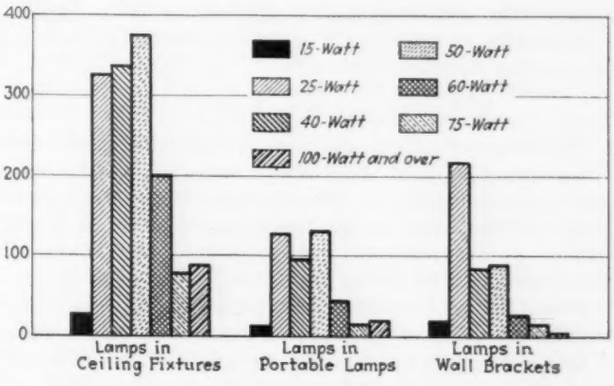


FIG. 1—NUMBER AND USE OF LAMPS PER 100 HOMES

The distribution of size (wattage) of lamps in different types of lighting equipment in the home.

The average number of lamps (bulbs) per room is presented in Table II for different types of lighting equipment in various rooms. It is seen that there is an average of 21.8 lamps per home exclusive of attic, closets, exterior and garage. In the kitchen it is seen that there is an average of 1.2 lamps in ceiling fixtures in the kitchen. This includes the smaller units, usually drop-cords, for auxiliary lighting. Only 1.6 lamps in the basement indicates great possibilities for development. In such a manner the data should be studied so as to reveal the possibilities.

The average watts per lamp (bulb) is presented in Table III for different types of lighting equipment in various rooms. In this table one may ponder over the possibilities of replacing existing lamps with lamps

[1] M. Luckiesh, Reports on Residence Lighting, *Proc.*, N. E. L. A., 1923 and 1925.

TABLE I—AVERAGE CONNECTED LOAD PER ROOM

	Ceiling Fixtures	Wall Brackets	Portable Lamps Floor	Portable Lamps Table	Totals
Living room	141	22	40	48	251
Dining room	125	13	5	14	157
Kitchen	74	12	..	...	86
Bedroom*	51	22	4	19	96
Hallways	60	14	..	...	74
Bathroom	38	32	..	...	70
Basement	75	6	..	...	81
Totals for 6½ rooms	640	154	55	109	958

* The average home consists of 6½ rooms, including 2½ bedrooms.

TABLE II—AVERAGE NUMBER OF LAMPS (BULBS) PER ROOM

	Ceiling Fixtures	Wall Brackets	Portable Lamps Floor	Portable Lamps Table	Totals
Living room	3.3	0.73	0.97	1.1	6.10
Dining room	2.9	0.46	0.13	0.3	3.79
Kitchen	1.2	0.29	....	....	1.49
Bedroom*	1.1	0.62	0.10	0.48	2.30
Bathroom	0.72	0.68	....	....	1.41
Hallways	1.28	0.4	....	....	1.68
Basement	1.44	0.16	....	....	1.60
Totals for 6½ rooms	13.54	4.28	1.35	2.60	21.8

* The average home consists of 6½ rooms, including 2½ bedrooms.

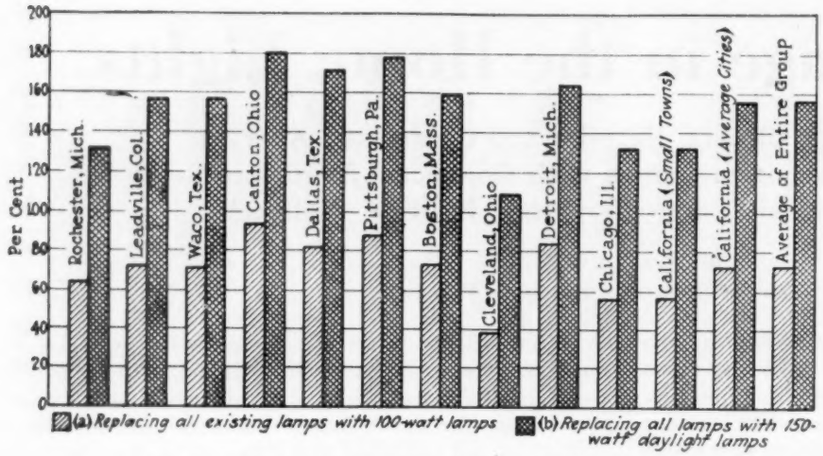


FIG. 2—INCREASING KITCHEN LOAD BY REPLACEMENTS

The increase in connected load due to installation of 100-watt regular lamps and 150-watt daylight lamps respectively in the principal ceiling fixture in the kitchen.

of greater wattage. These three tables will repay intimate study separately and combined, for such data are a necessity if guesswork is to be eliminated in campaigns for increased revenue.

DAYLIGHT LAMPS IN THE KITCHEN

The Mazda daylight lamp has certain advantages over the regular lamp in the kitchen, laundry, sewing room and even for reading. The customer uses 50 per cent more electrical energy for the same intensity of illumination as obtained by regular lamps. In return he obtains certain advantages such as better color discrimination, better blending with daylight, and, as many testify, a quality of light better for serious visual work. A few kitchen-unit campaigns have utilized the 150-watt daylight lamp, but many of them have exploited the 100-watt regular lamp.

It is interesting to compare the possibilities of the 150-watt daylight lamp with those of the 100-watt lamp in increasing connected load. This is done in Fig. 2 for various places in which accurate survey data reveal the present status of kitchen lighting. We know what the average wattage now is in ceiling fixtures in the kitchens in these places, and it is easy to compute the percentage increase in connected load that would obtain if the present ceiling fixture were replaced by a modern unit containing a 100-watt regular lamp or a 150-watt daylight lamp. Naturally the increase in connected load will depend upon the present average wattage in the kitchen ceiling units. For example, in Boston the 100-watt unit would increase the connected load about 73 per cent and the 150-watt unit would increase it about 159 per cent.

Considering that the 100-watt kitchen unit, in certain places at least, increased the net revenue per home by 100 per cent and the 150-watt unit by about 200 per cent, the choice of a unit for campaign purposes is a matter for serious consideration. In deploring the extremely low intensities of artificial illumination in general use a lighting specialist said: "Don't blame the public, for they are good sports. The real pikers in this matter are the electrical interests, because they haven't nerve enough or sense enough to try to sell adequate and proper lighting." Besides the advantage of better revelation of color which is desirable in the kitchen and the laundry, the blending of the light from the daylight lamp with natural daylight has some advantage. Furthermore, the high-intensity illumination is effective later in the morning and earlier in the afternoon and in most basements all day long. This, combined with the blending, tends to increase appreciably the period of operation of the "daylight unit" over that of the old lighting fixture. Many increases in profit are hidden in such intimate details.

One of the striking facts revealed by the two surveys which we have conducted is the fair uniformity or similarity in the results obtained in various places. However, one outstanding exception is the relative percentages of lamps of different wattages. These vary considerably, as shown in Fig. 3, for a number of places or groups of places. To one familiar with free-renewal policies of various electric-service companies the results for Detroit, Boston and Chicago, for example, are readily explained. In Chicago, the 60-watt lamp is supplied free and the influence of this policy is obvious. In Boston the 50-watt lamp is a free one and it has practically crowded out the 40-watt and 60-watt lamps. In Detroit the 40-watt leads, as it also does in Rochester, Mich., served by the Detroit Edison Company.

In the "grand average" the percentages of the 25, 40 and 50-watt lamps are approximately equal. This

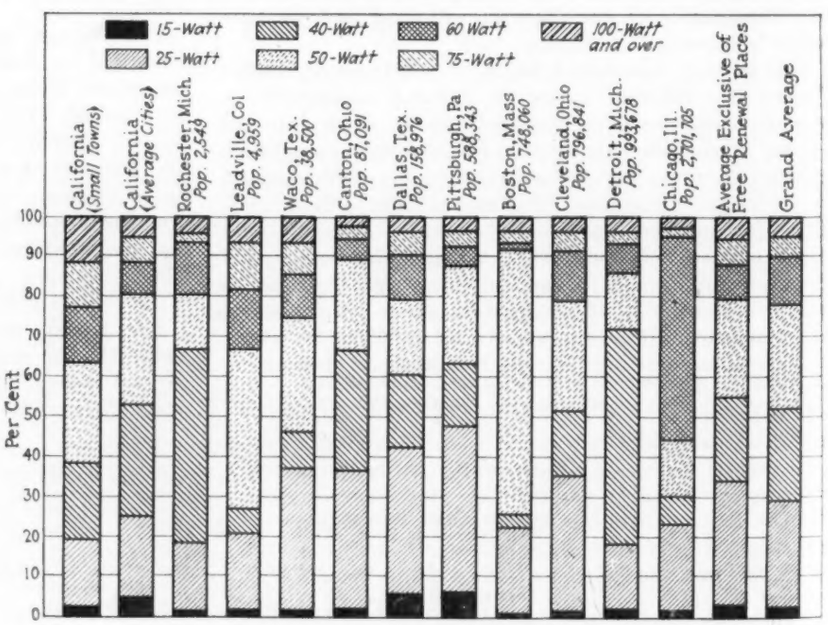


FIG. 3—LAMP WATTAGE DISTRIBUTION IN RESIDENCES

The percentages of lamps (bulbs) of different wattages in residences in various places

TABLE III—AVERAGE WATTS PER BULB

	Ceiling Fixtures	Wall Brackets	Portable Lamps Floor	Portable Lamps Table
Living room	42.6	30.8	41.2	43.0
Dining room	43.0	29.0	42.1	39.9
Kitchen	62.8	42.3	....	....
Bedroom	46.8	37.0	40.8	40.4
Bathroom	54.4	46.5	....	....
Hallways	47.0	35.8	....	....
Basement	52.0	37.5	....	....

average is not one "weighted" according to population, but it is interesting to note that there is little difference between a "straight" average and a "weighted" one. Next to the grand average is shown the average exclusive of the places in which free renewal is practised. Apparently where the public is not influenced by free renewals the 25-watt and 50-watt lamps become the two important lamps in the middle range. It may be somewhat surprising to find the 15-watt and 60-watt as rare in the home as 100-watt lamps and larger. It should be noted that the few lamps larger than 100-watt have been grouped with the latter in Fig. 3.

Besides presenting a view of the distribution of lamp sizes in the home, Fig. 3 reveals that this distribution is very susceptible to pressure from the electric service company. As increases take place in light-production and other developments come along, an intelligently devised policy can do much to influence the public in the use of lamps. The public needs plenty of guidance in the selection of lamps for various fixtures and it is getting very little of it from most merchandisers of lamps. In line with this need the leading lamp manufacturers developed "lighting recipes" for various fixtures in the home. But still more effort along this line must be exerted and the dealers and electric-service companies can do much to direct the use of proper lamps. The electric-service companies that have made a definite effort to increase wattage, where such increase is desirable and physically possible owing to the type of fixture, have met with success. More wattage as well as more lighting equipment is needed in the home, and it has been one of the objects of these surveys to show what is needed and where.

Letters from Our Readers

Requirements for a Good Utility Security

To the Editor of the ELECTRICAL WORLD:

The issue of the ELECTRICAL WORLD for November 7 contains on page 957 a brief article on "Eleven Tests of a Good Utility Security," presented as coming from a large investment house and embodying tests which "have been accepted as both inclusive and fair."

Several of these tests are not consistent with standards which have substantial recognition, being either too strict or too liberal. I am, therefore, taking the liberty of giving you the following comments covering what appear to be deficiencies in these tests, attaching to the comments the numbers by which the tests given in the article are designated:

1. Although franchise rights are still important and should ordinarily extend beyond the life of a bond, where regulation exists and certificates of public convenience and necessity are required before public service can be undertaken, and existing public utilities are otherwise protected, the term of the franchise is not vitally important. This is obviously the case in connection with bonds issued under an open-end mortgage, which may run far beyond the life of existing franchises.

4. It is not necessary for the safety of the utility bond that the preferred stock of the issuing company should be owned by its customers. Such ownership is conducive to the satisfactory public relations and competent management referred to under (3), but if such relations and management exist without customer ownership, the bondholder is reasonably protected.

6. Although it is desirable that earnings, both gross and net, show regular increases, a reduction in such earnings in a particularly unfavorable business year involves no necessary menace to the bondholder, particularly if the bond issue in question is a small part of the total capitalization.

7. The rule that interest charges should be earned twice before depreciation is a common one and reasonably safe for the conventional financial structure. It is, however, not always dependable. If the capitalization is low in relation to earnings or the bond issue is a small proportion of the total capitalization, the margin over bond interest required by this test may be a dangerously small percentage of the gross earnings, and this margin might be wiped out under unfavorable business conditions. In a book which he has recently published, "The Economics of Public Utilities," the writer, in discussing tests of public utility investments, has suggested what appears to be a more logical alternative, namely, that the margin after bond interest but before depreciation should be 20 per cent of the revenues for the corresponding period.

9. A provision that bonded debt should not exceed five times the gross earnings involves no protection to the bondholder of a normal property, which should have a total investment less than five times such gross earnings. Obviously, if the bonded debt is kept below 80 per cent of the property value, as proposed in (8), the ratio of this debt to gross earnings should be much less than five times, except in the case of hydro-electric or other unusual properties. In the book above referred to the writer has suggested an alternative test, namely, that the bond issue should not exceed six times the net earnings before depreciation or seven and a half times net earnings after depreciation. Such a test applies only to utilities with normal capital structures.

10. Twelve per cent of the gross earnings of a normal utility property is not sufficient to take care of combined maintenance and depreciation. This percentage should be increased by something like 50 per cent to take care of electric property and substantially more than 50 per cent for a railway property.

11. Exception may be taken to the statement that a modern mortgage should be "the main vehicle of financing." Conservative utility operators prefer to keep the indebtedness on their properties nearer 50 per cent of the total capitalization than the proposed 80 per cent, thereby reducing the required yield on junior issues and allowing greater opportunity for the advantages of customer ownership of such securities.

It is not practicable to apply any fixed rules to utility investments without discrimination. The history and character of a property and other pertinent factors should be known and suitable allowance therefor made before applying any specific tests. It is even then wise to have one's judgment confirmed by the opinion of a responsible investment banker.

L. R. NASH,
Vice-President Operating Division.
Stone & Webster, Inc.,
Boston, Mass.

Central Station and Industrial Practice

Prevention of Damage from Anchor Ice

BY A. P. BROADHEAD
Superintendent of Power, Associated Gas & Electric Company, Oneonta, N. Y.

ONE of the greatest troubles experienced by hydro-electric companies, particularly in Northern climates, is with anchor ice and frazile. The American term for this ice formation is simply "anchor ice." It is found attached or anchored to the bottom of a stream and is sometimes called "bottom ice" or "ground ice." There are three general kinds of ice: sheet ice, which forms on the surface; frazile, which forms in the middle of the water, and anchor ice at the bottom of the stream.

Anchor ice forms only when the weather suddenly turns cold and the sky is clear, and radiation is usually given as its cause. Water flowing over the rocks at the bottom of the river is always very close to the freezing point, with deviations from the freezing point seldom, if ever, greater than one-thousandth of a degree. Heat radiation from the bed of a river goes on all the time to the colder air above, although during the daytime under a clear sky heat is radiated from the sun down through the water, offsetting the cooling effect produced by the space radiation. In cold weather, on a clear night with the air still, radiation is excessive and ice forms quickly on the rocky bottom. Anchor ice forms most quickly just after sunset and before sunrise, but as soon as the sun rises the slightest change in temperature loosens the anchor ice and causes it to float to the surface. It will not form under a bridge or any similar obstacle, as the bridge acts as a check to radiation and reflects the heat rays back again to the bottom.

Anchor ice has immense power in lifting the rocks, stumps, sunken trunks, roots, weeds, etc., to which it forms. It carries these obstructions down stream with it when it breaks loose from the bottom, and in shallow rivers does much damage such as destroying canals and plugging up racks or waterwheels. Rivers 30 to 40 ft. in depth are not so much affected as the shallower streams.

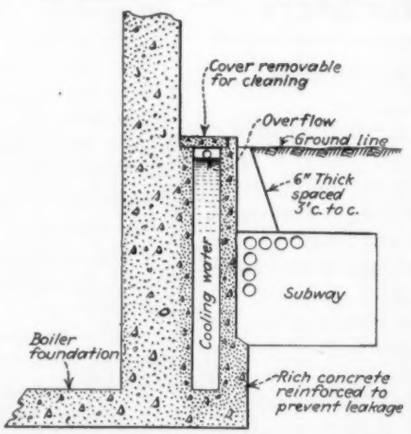
Power companies have various methods of fighting anchor ice. Common salt is often used, being thrown into the water ahead of the rack; bags of salt are often suspended ahead of the racks during ice attacks, and steam pipes are often placed against the base of the racks and the steam kept circulating. Racks are removed by some companies during the winter, and others build housings around the rack locations and allow heat to circulate from the generator room, so that no ice forms there and the ice that goes through does not collect.

In one of the Associated Gas & Electric Company's steam-hydro plants the condenser water from the turbines empties into the headrace, ahead of the racks, and while the turbines are running, no anchor ice forms, which proves that a difference of a fraction of a degree is all that is necessary to form or prevent the anchor-ice formation.

Water Jacket Saves Moving Subway

BY R. S. CARROLL
Portland Electric Power Company, Portland, Ore.

IN WORKING up plans for additional boilers at one of the steam plants of the Portland Electric Power Company, some of the layouts called for locating one of the furnace walls at such a point that it would adjoin a ninety-two-duct subway for a distance of 35 ft. Under such conditions the heat from the furnace wall would ruin the cables, and some other solution to the problem had to be found.



COOLING SUBWAY BY WATER JACKET SAVED SEVERAL THOUSAND DOLLARS MOVING EXPENSE

Moving the subway would be a difficult and expensive piece of work and would involve the building of three or four large manholes and approximately 100 ft. of subway, the lengthening of all cables in the subway and a great deal of temporary work to keep the plant in operation while the work was being carried out. Instead of moving the subway it was proposed to build a water jacket in the furnace foundation wall where it was adjacent to the subway and circulate water through the jacket from the turbine condenser supply header. The proposed arrangement is shown in the accompanying diagram.

Under the conditions assumed it would be necessary for the water to carry away 120,000 B.t.u. per hour. Assuming a water supply temperature of 70 deg. F. and a discharge temperature of 100 deg. F., 8 gal. per minute would be required. Using air under the same temperature limits would require 4,100 cu.ft. per minute. Water was therefore recommended, as it will be available at a slight expense for piping, whereas the use of air would necessitate the installation and maintenance of a blower.

The estimated cost of building the water jacket in connection with the boiler foundation, including the necessary pipe connections, etc., is $540, and it can be installed without inconvenience, whereas moving the subway would have run into thousands of dollars and would have interfered considerably with the operation of the plant.

Secondary Racks Stand Up Under Storm Conditions

WITHIN the past year the Bloomington division of the Illinois Power & Light Corporation experienced one of the most severe sleet storms in the history of that section, and N. J. Butler, superintendent of distribution, reports that the secondary racks used on the distribution system have in general given less trouble from storms than have the cross-arm construction. Mr.

Special Type of Truck Proves Efficient for Pole Setting

THE New Jersey Power & Light Company has developed equipment for its distribution trucks at Dover, N. J., which greatly expedites pole setting. Any pole up to a length of 35 ft. is handled, as shown in the illustrations, by a truck crew consisting of a driver and one other man.

Butler attributes this performance in favor of the racks to the following reasons: (1) Cross-arm construction offers a greater exposure to injury from falling trees; (2) trees falling on secondaries supported in racks causes the wires to slip in the insulators or even to break, but puts little strain on the poles; (3) greater percentage of poles broken in sleet storms used cross-arm construction. This condition was due to the twisting action caused by breaking of wires on one side of pole, which added torsional stresses to the already abnormal loading due to ice on conductors.

Radio Interference Analysis

BY L. J. CORBETT
Assistant Engineer Pacific Gas & Electric Company, San Francisco, Cal.

AS AN indication of the proportionate effect of various causes of radio interference, the following analysis of 294 cases recently located by the Pacific Gas & Electric Company is presented. In addition to these, 181 cases were undetermined —either they cleared themselves or they were not yet located at the time of the report. The analysis is given in Table I.

It will be noted that cracked or dirty insulators lead the list with more than 30 per cent. Tree grounds follow with 17 per cent and defective switch contacts with almost as much. Imperfect grounds on the neutral at transformers account for 7.1 per cent. About 6.1 per cent were due to defective radio sets, and 4.8 per cent to consumers' circuits and equipment. Guy contacts and street-lighting cutouts account for 3.8 per cent each. A particularly baffling cause consists in metal parts in the electric field picking up charges which pass to ground over an imperfect circuit with one or more small gaps. This accounted for 2.7 per cent of the cases traced. Miscellaneous other causes were 7.8 per cent.

It is also interesting to note how the voltage of the line affects the number of radio interference cases. The number and percentage of cases occurring on the lines of different voltages are listed in Table II. This indicates that the higher voltage distribution circuits, including the 11-kv., 6.6-kv. and street-lighting circuits, have more radio trouble charged to them than either the secondary or the high-voltage transmission lines. The percentages are not in proportion to mileage of the respective lines, but indicate the different electrical factors of safety applying on standard equipment at the different voltages.

The company's method of handling radio interference cases is as follows:

Local complaints are made to the district or division offices. The division forces call upon the complainant and learn the nature of the interference. In some cases the cause is obvious, and it is rectified if on the company's lines. In other cases the complainant is asked to keep track of the interference for a few days and report again. This is often the last heard concerning it. Reports of all complaints are sent in to the head office in San Francisco. Here a man in the operating department, delegated for this work, collects and co-ordinates them. Further, he is equipped with a sensitive receiving set and goes out on particularly baffling cases. The cards for reports call for a description of the noise, its nature, tone, time of occurrence, etc., and from such data this man is able in many cases to suggest the cause and remedy.

The information in the tables is from data collected by C. C. Campbell of the operating department of the company, who handles this work in the head office.

TABLE I—ANALYSIS OF 294 CASES OF POWER LINE INTERFERENCE WITH RADIO RECEPTION

Cause	Number of Cases	Per Cent of Total
Cracked or dirty insulators	89	30.2
Defective switch contacts	49	16.7
Tree grounds	50	17.0
Guy grounds	11	3.8
Transformer neutral grounds	21	7.1
Street-lighting circuits	11	3.8
Metal in field	8	2.7
Consumers' equipment	14	4.8
Defective radio sets	18	6.1
Miscellaneous other causes	23	7.8
Total found	294	100.0

TABLE II.—CASES REFERRED TO LINE VOLTAGE

Voltage of Circuit	Number of Cases	Per Cent of Total
60 kv.	9	3.4
11 kv.	129	49.3
2.3 to 6.6 kv.	56	21.4
Secondary	19	7.2
Street lights	49	18.7
Total	262	100.0

Converting an Oil-Fired Furnace to Electric Heating

By W. J. WALSH
General Manager Delta File Works, Philadelphia, Pa.

SEEKING to improve the quality of its finished product, the Delta File Works recently investigated the metallurgical advantages of electric heating. Our research and process development had carried us close to the limit of progress as regards the metallurgical make-up of the raw stock, but there were apparent gains to be obtained when considered from the standpoint of surface conditions and metallurgical change which are the result of heat-treatment.

We were faced, however, with two conditions that must be considered by the average plant management contemplating the use of electric heat. First was the fact that we had available certain furnace equipment then operating with oil fuel, which represented an investment of considerable amount; with definite and reasonable costs of operation, and with the only objectionable feature of variables in the result. On the other hand, we were presented with the miscellaneous claims of electric furnace engineers plus the different data that had been published on results obtained in electric furnaces.

After considerable investigation, it was decided to accept a proposal made by F. J. Ryan & Company of Philadelphia for the reconstruction of one of our oil-fired units. This unit consisted of three heating chambers separately under-fired, and with the usual standard dimensions of firebrick lining. The proposal of the Ryan company was to carry an insulated wall on the outside of the present chambers and to install the Bechtel patented method of resistor support within two of these chambers, under the control of one pyrometer.

This change-over is of considerable interest, not so much as it pertains to the metallurgical result as from the fact that it has made use of equipment that would otherwise have been discarded if electric heat had been adopted on new furnaces. The cost of investment is approximately 50 per cent of the cost of new furnaces, and the results indicate that the efficiency reaches a point comparable with any results that have been obtained in electric furnaces of entirely new construction.

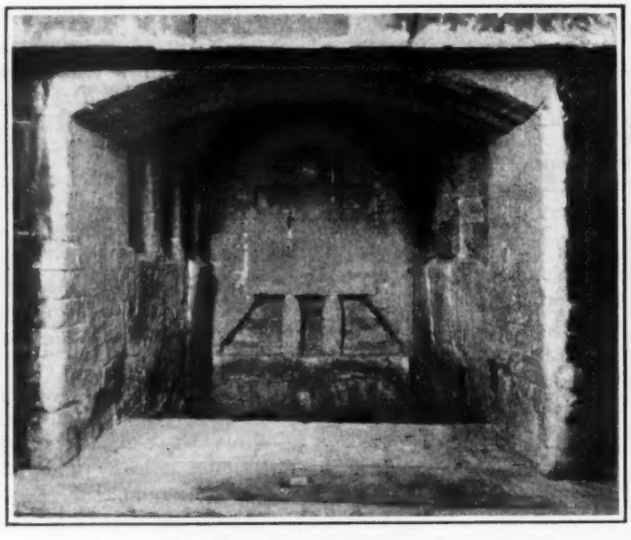


FIG. 1—OIL-FIRED FURNACE BEFORE CONVERSION

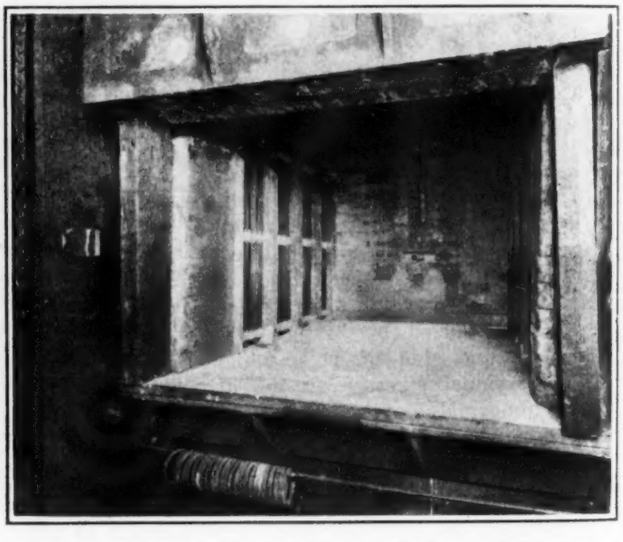


FIG. 2—ELECTRIC FURNACE BUILT INTO FORMER OIL FURNACE

In reconstruction of the furnace, the floors of two of the chambers were simply bricked up and the resistor groups were inserted along the side walls, 60 kw. capacity of resistors being inserted in each chamber. Fig. 1 shows one of the chambers before reconstruction and insertion of the heaters, and Fig. 2 shows the chamber after reconstruction and insertion of the heaters. The entire outside of the furnace is surrounded with a steel plate casing placed 4½ in. away from the existing furnace wall. Into this space was rammed 4½ in. of "C-3" dry pebble mixture.

Only one pyrometer controller was installed. The furnaces operate at night to obtain the low rate available on off-peak loads, which is $0.007 per kilowatt-hour. By having two chambers available for heating it is possible to operate one chamber at night, allow it to cool during the day, at the same time recharging the other for operation the next night.

Leeds & Northrup two-point special gun furnace control was adopted. This instrument produces a two-couple record. The switching of the power and thermocouple connections is designed to make it impossible for a "mix-up" to take place whereby power could be on one chamber and the thermocouples on the other chamber.

The heat-treating operation carried out in this furnace is the annealing of file blanks in order to soften the steel preparatory to cutting the file teeth. The stock is high-carbon file steel, the only operation prior to this annealing being the forging of the tang ends on the hot-rolled bar stock. The file blanks are piled on a cast-iron skid arranged for handling by lift truck. The sides of this skid are provided with holes which allow free circulation of heat beneath the charge while the loading skid is in the electric furnace. This skid weighs approximately 500 lb. and holds a charge of approximately 5,000 lb., so that approximately 9 per cent of the heat absorbed is used for heating the skid on each charge.

A check-up of the cost of both types of operation is interesting, especially as it did not bear out our fears that the cost of electric heating would be higher than could be charged off to improvement of prod-

uct. The oil furnaces before changeover showed an average cost of $6.20 per 4,000 lb. (average weight charge), or $3.10 per net ton of material treated. Records of the operation of the electric furnace covering approximately a three-months period show that the cost is $6.47 per charge of 5,600 lb. weight, as it was found possible to charge additional weight into the rebuilt furnace, or a net cost of $2.30 per ton. The costs referred to above are actual factory costs and do not include overhead charges.

There has been included in the electric cost a charge of $1 per operation for heater replacement. This charge is high when compared with the results that are being obtained, but is included rather than favor the electric heat. It can be seen from the comparison of these figures that rather than being more costly, we are heating by electricity in this particular installation at a lower cost than we were with oil.

Summing up, it is found, first, we are treating pound for pound with electric heat at a lower cost than we were with oil fuel; second, from the same furnace chamber we are able to produce 20 per cent more tonnage; third, we have eliminated an inclination to spotty treatment as was the case in the fuel furnace; fourth, because of uniformity of treatment the percentage of files that may be cut per chisel has been increased; fifth, we are now able to duplicate accurately every treatment without dependence upon the human factor, and finally, as will be apparent to anyone who has considered this question, we have improved materially working conditions at this location.

While from the superficial consideration of plant beauty it may be ideal to build furnaces of entirely new construction, it is not practical now, nor will it be practical for many years, to do away with the existing furnace units owing to their initial cost and the investment that must be made productive before their discontinuance. The results in this installation indicate that such discarding of present equipment in many cases may not be necessary.

Research Laboratory Raises System Power Factor

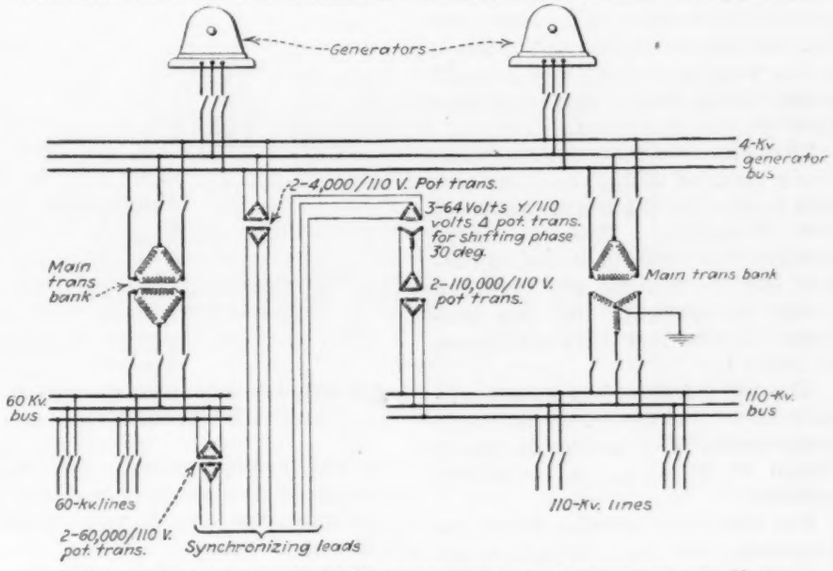
IN CONNECTION with the building of a transformer for extreme high-voltage research at the Worcester (Mass.) Polytechnic Institute under Prof. H. B. Smith, director of the department of electrical engineering, a 600-hp. Westinghouse synchronous motor-generator set has lately been installed to supply energy for testing and investigations. The set is operated on the service of the Worcester Electric Light Company, and to secure power factor correction, the institute and the company agreed to run the unit with overexcited field between 7 a.m. and 5 p.m., the company furnishing the energy in exchange for the corrective results secured. The motor-generator set was supplied by the research organization, and has been housed in a corner of the laboratory to insure quieter operation, extra ventilation being furnished by a motor-driven fan exhausting outside the building.

The motor of the set is wound for 2,300 volts and is supplied from the Faraday Street substation of the company, about one-fourth mile distant. At this substation there are two banks of transformers stepping down from 13,200 to 2,300 volts, one bank being rated at 1,500 and the other at 3,000 kva. Previous to the installation of the set, the load at Faraday Street was approximately 145 amp. at 13,200 volts, or 3,320 kva., with a power factor of 66.3 per cent. This necessitated operating both transformer banks during the ordinary day load. After the installation of the set, the load was cut to 125 amp., or 2,860 kva., and the power factor rose to 77 per cent. This enables the company to cut out the 1,500-kva. bank, and the reduction in current and losses is of course effective on the feeders from the generating station to Faraday Street, a distance of about three miles. The kilowatt-hour consumption of the synchronous motor-generator set is about 400 kw. per day.

Overcoming Synchronizing Difficulties

BY RICHARD MCKAY
Assistant Engineer Washington Water Power Company, Spokane, Wash.

IN TYING a new 110-kv. line into one of the power plants of the Washington Water Power Company it was found that by reason of the transformer connections employed there was a 30-deg. difference in phase between the secondary of the potential transformers connected to the 110-kv. bus and the potential transformers on the 4-kv. generator bus. To synchronize the 110-kv. bus under these conditions it would have been necessary to close the oil circuit breaker with the synchroscope 30 deg. off the vertical position, a method not at all desirable, as the synchroscope also had to be used in the normal manner when synchronizing with the 60-kv. bus.



SPECIAL SET OF Y-DELTA POTENTIAL TRANSFORMERS COMPENSATES FOR 30-DEG. PHASE SHIFT PRODUCED BY MAIN TRANSFORMER BANKS

To overcome this difficulty a set of Y-delta potential transformers was connected to the secondary of the 110-kv. potential transformers in the manner shown in the accompanying diagram. This in effect produced a one-to-one transformation with the desired 30-deg. phase shift, permitting the synchroscope to be used in the normal manner. The three extra potential transformers were obtained from one of the electrical manufacturers at a cost of $60.

Commercial Activities and Public Relations

Central-Station Service Most Economical

How a Careful Analysis of Hot Water Required for Process Work and Study of Costs with Isolated Plant Showed Marked Saving by Purchasing Power

BY H. C. THUERK
Engineer Penn Public Service Corporation, Erie, Pa.

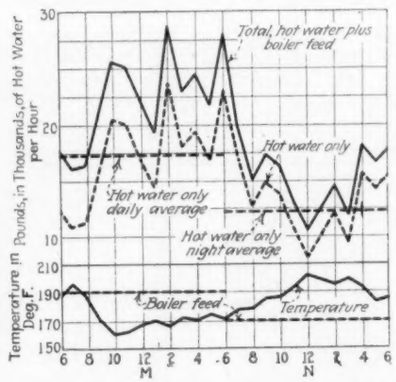
AMONG the customers of the Penn Public Service Corporation is a meat-packing plant that has used central-station service for a number of years. Previous to January, 1924, the power requirements of this customer consisted of an induction motor and lighting load of 80 kw. and a direct-current motor load of 20 kw. The alternating-current requirements were purchased and a small steam engine-driven generator supplied the direct current.

The direct-current motors were finally replaced with alternating-current motors and the steam engine set was discarded. This procedure brought the entire alternating-current load up to about 100 kw. The power requirements for this customer for the year 1924 are shown in Table I.

The refrigerating equipment consists of two steam-driven ammonia compressors, the larger of which (rated at 75 i.h.p.) is ordinarily operated.

For sime time previous to the replacement of the direct-current motors with alternating - current motors the temperature of the hot water used in the plant varied over a wide range. This variation is shown in the accompanying chart. About this time the representative of one of the large steam-engine manufacturers recommended the installation of a uniflow engine and alternator, stating that power could be generated at less cost than purchased power and the additional exhaust steam obtained from the engine would raise the temperature of the hot water and maintain it at a more nearly constant value.

The power company was brought in at this point and its representative was asked to investigate conditions and make a report. An examination of the coal records seemed to indicate that only a very small portion of the exhaust steam of the direct-current generating unit had been utilized. The coal figures are as follows:



HOT WATER FOR PROCESSES AND BOILER FEED-WATER REQUIREMENTS

TABLE I—MONTHLY DEMAND AND ENERGY CONSUMPTION, 1924

Month	Kilowatt Demand	Kilowatt-Hours
January	104	23,520
February	91	19,520
March	99	17,920
April	88	16,320
May	104	16,480
June	102	17,920
July	106	18,080
August	104	16,960
September	98	16,480
October	98	17,440
November	104	19,200
December	96	16,320
Total		216,160

Period	Total Lb. Coal	Lb. per Month
Jan. to April, 1923, incl.	1,734,250	433,560
Nov. to Jan., 1924, incl.	1,245,000	415,000
Difference		18,560

It will be noted that during November to January, 1924, inclusive, when all power requirements were purchased for six weeks, the monthly consumption of coal was less by 18,560 lb. than during the period of January to April, 1923. As the generating unit was discarded about the latter part of December, 1923, current for the new alternating-current motors was purchased for only one-half of the period from November to January, 1924, inclusive. If current for these motors had been purchased for the entire three months, the coal saving would have been doubled. The monthly coal saving was therefore 37,120 lb., or 18.5 tons, which at $5 per ton represents an expenditure of $92.50. The additional purchased power cost about $65, thus making a net monthly saving of $27.50 by shutting down the engine set.

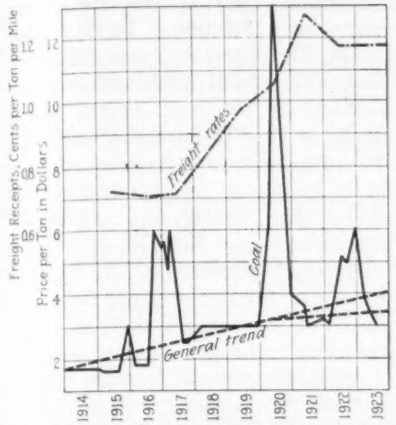
This reduction in coal consumption indicated that only a small portion of the exhaust steam from the generating set was utilized. The lack of hot water at certain times during the day was evidently not due to a lack of exhaust steam.

A survey of the boiler room equipment showed that the exhaust steam from the ammonia compressor was passed through a closed type boiler feed-water heater and thence to atmosphere, through a relief valve. Both the boiler feed water and hot water for the plant processes were taken directly from the closed heater. It was observed that during certain periods exhaust steam passed out to the atmosphere. In the summer months a very considerable amount of exhaust steam was not utilized.

To determine the amount of water required for boiler feed and for plant purposes, a counter was installed on the feed pump, through which passed all the water going into the heater. Readings of the counter were taken hourly for three days and from these readings the total water consumption curve was plotted as shown. This curve shows that the demand for hot water, for both boiler feed and process, varied from 11,000 lb. per hour to 29,000 lb. per hour.

It was clearly evident that a storage water heater would serve to utilize the wasted exhaust steam and maintain a higher temperature at the times of the peak water demand. This course was recommended and at present storage tanks are being used with satisfactory results.

In addition to this recommendation, a power cost comparison was presented showing that power was being purchased at a lower price than that for which it could be made with a generating unit. The comparison was based on a maximum fifteen-minute demand of 110 kw. and a monthly consumption of 22,650 kw.-hr. As power is purchased at primary voltage, an allowance of



FREIGHT RATES AND BITUMINOUS COAL PRICES, F.O.B. MINE

715 kw.-hr. was made for transformer losses, making a total of 23,365 kw.-hr. per month. The net monthly cost of this power purchased from the power company was $447.04, or an average cost of 1.98 cents per kilowatt-hour delivered at secondary voltage.

Table II shows how the cost of generating power was determined. The generating unit considered consisted of a 187-kva., 220-volt, three-phase, 60-cycle alternator driven by a uniflow engine. At a power factor of 70 per cent, this unit would have a normal rating of 131 kw.

The installation of a reserve unit or the use of the power company's service for break-down purposes would have increased the fixed charges about $1,200 per year. The cost of power with coal at $5 per ton would then have been $0.029 per kilowatt-hour and with coal at $6 per ton would have been $0.0323.

It will be noted that in this comparison no charge was made for labor, as a licensed engineer was necessary on account of the refrigeration equipment.

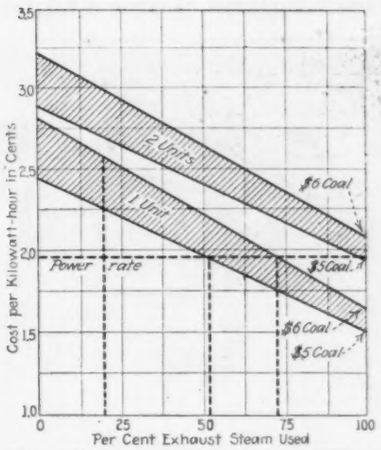
An over-all coal rate of 6½ lb. per kilowatt-hour was used in the comparison for the following reasons: The average load during the day (ten hours) was 70 kw., or 54 per cent of normal rating of the alternator, and at night and Sundays was only 11 kw., or 9 per cent of normal rating. The average load over a twenty-four-hour period was about 32 kw., or about 25 per cent of the normal rating of the alternator.

The evaporation rate of the boilers was estimated at not more than 7 lb., so that the steam rate of the unit was about 45 lb. per kilowatt-hour. Taking into consideration the efficiency of the alternator and engine, this was equivalent to about 23 lb. per indicated horsepower-hour.

It was undoubtedly true that a certain amount of the exhaust steam from the proposed unit could be utilized by the heating system in the winter months. In order to determine the relation between the cost of power and the amount of exhaust steam used, Table III was used. This table was obtained from "Mechanical and Electrical Cost Data," by Gillette and Dana, page 481, and revised to show percentage instead of actual coal consumption. Using this table, a chart was prepared showing the relation between the cost of power and the percentage of exhaust steam used. In preparing the chart, Table IV was first compiled.

From the chart it was evident that with purchased power available at $0.0198 per kilowatt-hour, it would be necessary to utilize at least 52 per cent of the total exhaust steam from the proposed unit before any saving would be effected with coal at $5 per ton. When coal was $6 per ton, it would be necessary to use 73 per cent of the exhaust. These figures have been based on the assumption that only one generating unit is to be installed. If two units are installed or the power company's break-down service is used to insure continuous service, then no saving will be effected even if all of the exhaust is used.

A very generous estimate of the requirements of the heating system showed that only about 30 per cent of the total exhaust steam available in the six winter months would be used for this purpose. Based on the



RELATION BETWEEN COST OF POWER AND PER CENT OF EXHAUST STEAM USED

exhaust steam available during the entire year, the heating system would utilize only 15 per cent. However, to be conservative and allow for a portion of the exhaust steam that would be used for heating water in the winter time, it was assumed that 20 per cent of the entire exhaust steam of the proposed unit would be used.

Reference to the chart shows that when 20 per cent of the exhaust steam is utilized the cost of generating power with one unit would be $0.0227 per killowatt-hour with $5 coal and $0.026 per kilowatt-hour with $6 coal.

The savings to be realized through the continued purchase of power in this plant are summarized in Table V.

It should be noted from the power requirements for 1924 that the

TABLE II—COST OF GENERATING POWER

Investment	$11,000	
Fixed charges at 14 per cent		$1,540
Operating expenses		
Coal, 900 tons at $5		4,500
Repairs and maintenance		400
Lubricants and supplies		240
Total annual cost for 271,800 kw.-hr.		$6,680
Cost per kilowatt-hour		$0.0246

At coal cost of $6 per ton cost per kilowatt-hour would be increased to $0.028.

TABLE III—RELATION BETWEEN COST OF POWER AND USE OF EXHAUST STEAM

Per Cent of Exhaust Used	Per Cent of Coal Chargeable to Power
0	100
25	86
50	72
75	57
100	43

TABLE IV—SHOWING RELATION BETWEEN COST OF POWER AND PER CENT OF EXHAUST STEAM USED

Per Cent Exhaust Used	Per Cent Coal Chargeable to Power	Cost of Coal Chargeable to Power	Fixed Charges Plus Repairs and Lubricants	Total Cost for Power	One Unit: Net Cost per Kw.-Hr. $5 Coal	One Unit: Net Cost per Kw.-Hr. $6 Coal	Two Units: Net Cost per Kw.-Hr. $5 Coal	Two Units: Net Cost per Kw.-Hr. $6 Coal
0	100	$4,500	$2,180	$6,680	$0.0246	$0.0280	$0.0290	$0.0323
25	86	3,870	2,180	6,050	0.0223	0.0251	0.0267	0.0295
50	72	3,240	2,180	5,420	0.0200	0.0224	0.0244	0.0268
75	57	2,565	2,180	4,745	0.0175	0.0194	0.0219	0.0238
100	43	1,935	2,180	4,115	0.0152	0.0166	0.0196	0.0210

Table based on 6½ lb. of coal per kilowatt-hour and 271,800 kw.-hr. per year.

TABLE V—SAVINGS REALIZED THROUGH CONTINUED PURCHASE OF POWER

Cost of Coal per Ton	One Unit: Cost per Kw.-Hr.	One Unit: Annual Cost	One Unit: Annual Saving by Purchasing Power	Two Units: Cost per Kw.-Hr.	Two Units: Annual Cost	Two Units: Annual Saving by Purchasing Power
$5.00	$0.0227	$6,169.86	$805.38	$0.0272	$7,392.96	$2,028.48
6.00	0.026	7,066.80	1,702.32	0.030	8,154.00	2,789.52
Cost of purchased power	0.0198	5,364.48				

New England Women Utility Employees Meet at Hartford

INTEREST in public relations is mounting high among the women employees of the electric utilities of New England, who are now reaping the results of a pioneer convention of the women's committee of the New England division, N. E. L. A., at Hartford, Conn., in October. From the Hartford meeting illustrated above women delegates have returned home fired with enthusiasm for the opportunities of the central-station industry in building friendship among customers and the public, and many local educational and public relations activities are being started as a result of the gathering.

average monthly consumption was 18,013 kw.-hr. The power cost comparison was made on the basis of an average monthly consumption of 22,650 kw.-hr.

In this report attention was called to the fact that during the past ten years all of the items that enter into the installation and operation of an isolated power plant had constantly increased in cost, whereas the cost of electric power distributed by central stations had, in general, been decreasing. The chart showing coal prices and freight rates illustrated this condition.

Other items which were brought out in the report were: (a) Generating plant may be obsolete in few years due to increased demand for power; (b) central-station power is more dependable than the isolated plant; (c) there is a decided tendency for plant managers to pass responsibility of power production to the power company.

After full consideration had been given to the reports of both the steam-engine manufacturer and the power company, it was decided that the most desirable and economical plan was to continue the use of purchased power.

Merchandise Sales $11.10 per Meter

MERCHANDISE to the amount of $132,018 was sold in twelve months by the Bloomington division of the Illinois Power & Light Corporation, with stock inventory of only $16,222 and with 12,000 residence meters. The sales per month are shown in the accompanying tabulation. At the beginning of the twelve-month period the stock inventory was $29,000. During the year M. H. Skidmore, new-business manager for the division, reduced the inventory 44 per cent, at the same time increasing the gross sales.

MONTHLY MERCHANDISE SALES OF THE BLOOMINGTON DIVISION, ILLINOIS POWER & LIGHT CORPORATION

September, 1924	$10,091.02
October, 1924	10,536.42
November, 1924	12,686.08
December, 1924	11,076.98
January, 1925	18,692.99
February, 1925	8,994.66
March, 1925	10,489.91
April, 1925	9,778.71
May, 1925	8,539.17
June, 1925	9,183.63
July, 1925	10,162.27
August, 1925	11,786.82
Total*	$132,018.66

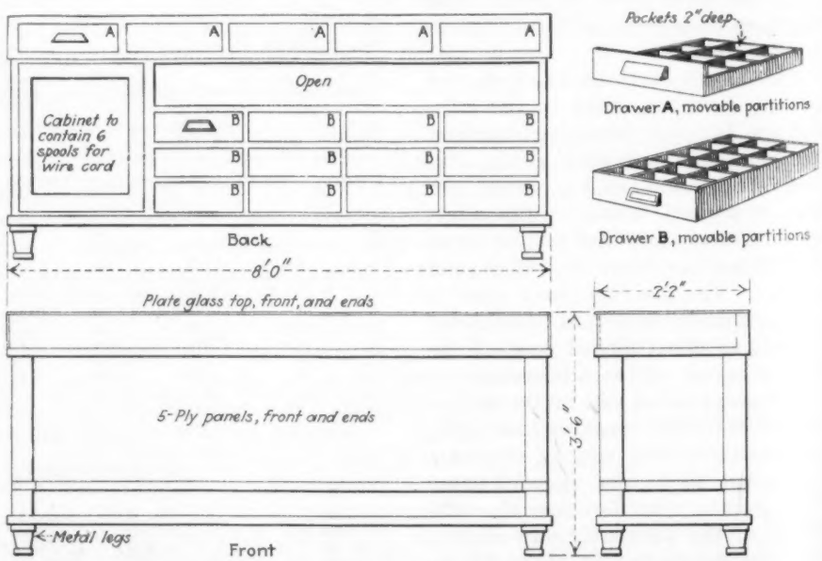
*Includes $2,000 for house wiring.

The Bloomington division of the Illinois Power & Light Corporation includes the contiguous cities of Bloomington and Normal, Ill., with a combined population of 37,000. Several near-by towns bring the total population served to 43,000. The sales force includes two men on electric washers, two on cleaners, and one floor saleswoman. Store sales for the year were more than $45,000. The advertising budget was 3½ per cent of gross sales.

A Standard Display Counter for Appliance Salesroom

IN EQUIPPING its various district offices for the sale of appliances, the Oklahoma Gas & Electric Company has endeavored as much as possible to standardize wallcases and show cases and make their arrangement uniform throughout.

A feature of all the stores is a "utility counter," the design of which is shown in the illustration below. The counter has a glass top with trays immediately beneath the top. In the pockets of these trays are displayed the hundred and one small supply and repair items that are called for every day. Many customers will recognize in one of these pockets the part wanted, although they may not know its trade name. Use of this type of showcase has proved a great convenience to customers and has increased sales.



ARRANGEMENT OF "UTILITY COUNTER" FOR DISPLAY OF SMALL SUPPLY PARTS

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Rational Design of Covering for Pipes Carrying Steam up to 800 Deg. F.—W. A. CARTER and E. T. COPE.—The authors present an analysis of the problem of determining the most economical thickness of pipe covering for steam pipes carrying steam at a total temperature of 500 deg. F. and at higher temperatures up to 800 deg., based on the work of Heilman, Eberle and others. Two cases are considered—first, in which the temperature is 500 deg. and a single covering material is used; second, in which the steam temperature is 700 deg. and a compound covering is used, made up of a layer of higher-temperature-resisting material next to the pipe and a layer of lower-temperature material over it. The graphical determinations and computations are explained with the aid of curves and equations. What is now published is an abridgment of the paper as presented at the spring meeting of the A.S.M.E., May 18 to 21, 1925.—*Mechanical Engineering*, October, 1925.

Tests Made on Largest Hydraulic Turbine at Holtwood.—ROBERT E. TURNER.—Using the Allen salt-velocity method to test a 20,000-hp. 54-ft.-head turbine, connected to a short penstock on a river where the water has a high conductivity, the flow of water was successfully determined. The salt solution was injected by means of forty quick-acting pop valves near the headgates. This event was recorded by a graphic ammeter, as was the passing of the solution through a group of eight electrodes at the lower end of the penstock. Time was indicated on the ammeter chart by perforations made by a spark controlled by a seconds pendulum. From the record the interval required for the center of mass to traverse the penstock was determined; this, with the known dimensions, gave the rate of flow. Effective head was found by piezometer plates at the entrance to the turbine casing, with allowances for velocity head at intake and discharge. Maximum efficiency of the turbine at 54-ft. net head was 92.8 per cent at an output of 17,200 hp. with 65.5 per cent gate opening; at 54-ft. gross head the operation is about 4 per cent less efficient, owing to site losses. Sectional views, diagrams and charts accompany the article.—*Power*, Oct. 20, 1925.

Generation, Control, Switching and Protection

No-Load Characteristics of Salient-Pole Machines.—H. DE PISTOYE.—The most complex part of the determination of the no-load characteristics of electric machines constitutes the calculation of the ampere-turns required for the air gap and the slots and the exact evaluation of the Hopkinson coefficient. Without decreasing the accuracy of the obtained results, the author develops a new, much simplified method of calculating these characteristics. To generalize his method, the author gives a number of curves for various actual slot conditions and ampere-turns on commercial machine types.—*Revue Générale de l'Electricité*, Oct. 24, 1925.

Stability and Overload Capacity of Power Systems.—AUGUST BERGGREN.—An investigation of the conditions for the Trollhättan-Västeras power system in Sweden, based on the methods previously developed by Fortescue, Wagner and others.—*Teknisk Tidskrift (Swedish), Elektroteknik*, Oct. 3, 1925.

Problems of Shaft Deflection.—ROBERT LOCHNER.—Solutions are discussed of two special problems sometimes arising in the design of electrical machinery—(1) when the center of gravity overhangs the center of support, as in the case of a flywheel alternator; (2) when the hub and coupling of a direct-connected machine are in one piece, the shaft being pressed into the hub and projecting at one end only, where a bearing surface is provided. These cases are analyzed mathematically and formulas are deduced for approximate solutions when certain simplifying assumptions are made.—*Electrician (England)*, Oct. 16, 1925.

Construction Methods on a 720,000-Hp. Generating Station.—FRANK W. SKINNER.—The station in question is the new plant of the New York Edison Company at Fourteenth Street and Avenue D. The article is descriptive and includes data and illustrations.—*Engineering (England)*, Oct. 9 and 23 and Nov. 6, 1925.

Transmission, Substations and Distribution

Meter Connections on Neutral-Grounded Three-Phase Systems.—D. FREYER.—The author calls attention to the fact that in four-wire, three-phase networks with grounded neutral single-phase meters must be connected properly to prevent illegal consumption of energy and to record ground currents on the consumer's premises. It is not immaterial whether the single-phase meter is connected into the neutral wire or a phase wire. Only in the latter case can proper indication and full protection be insured.—*Elektrotechnische Zeitschrift*, Oct. 1, 1925.

Rectifiers. No. XII.—The concluding section of this long serial takes up the transverter and the Delon cable-testing apparatus.—*Engineer (England)*, Oct. 9, 1925.

Mississippi River Crossing of Crystal City Transmission Line.—H. W. EALES and E. ETTLINGER.—A brief summary of this paper was given in the report of the A. I. E. E. spring convention in the ELECTRICAL WORLD for April 25, 1925, on page 863. As now published, the paper first describes the conditions that were to be met and then shows how the problem of bridging a space of nearly 7,000 ft. was solved by the use of a two-span construction, with one span of 4,279 ft. over the river itself and one of 2,681 ft. over the adjacent lowlands. The detailed description is followed, in an appendix, by the sag and stress computations for the longer span. The length of the latter and the obligation to meet definite specifications as to clearance dictated the use of the catenary formula, rather than the approximation of assuming the curve to be a parabola. The unequal altitude of the supports had also to be taken into account.—*Journal of A. I. E. E.*, October, 1925.

Motor Converters Versus Rotary Converters.—G. WUTHRICH.—In a communication the writer criticises the tendency to specify motor converters for changing alternating current to direct and controverts successively the claims made in favor of these machines. His argument is that the same or equivalent advantages are possessed by the rotary, which is, in addition, less costly and more efficient, the latter in the ratio of about 94 per cent to 89.5 per cent for a 1,000-kw. equipment.—*Electrician (England)*, Oct. 30, 1925.

Units, Measurements and Instruments

Ground Indicator.—W. GAARZ and J. SORGE.—Many serviceable instruments are available to indicate accidental and permanent grounds on extended networks. Experience has shown, however, that such permanent grounds are very frequently preceded by flashovers at the weak points, but that these flashovers are of such exceedingly short duration as to prevent their indication on the ground-indicating instruments. The duration of such momentary flashes is usually only one or two cycles. The article describes a new, highly sensitive relay which is guaranteed to make a contact even for an impulse of a few milliseconds duration. The instrument is built on the electrodynamic principle, has an impedance of 2 ohms and reacts at 5 milliamperes. Its consumption is only 0.00005 watt, while its current coils may carry permanently 5 amp. The contact on the relay operates an annunciator with a dropping signal disk, which in turn may operate a bell circuit.—*Siemens Zeitschrift*, September, 1925.

The Klydonograph and Its Application to Surge Investigation.—J. H. COX and J. W. LEGG.—This paper was abstracted at considerable length in the report of the annual convention of the A. I. E. E. in the ELECTRICAL WORLD for July 4, 1925, on page 17. As now published, the paper contains numerous views of "Lichtenberg figures," produced directly on photographic plates by the surges under investigation.—*Journal of A. I. E. E.*, October, 1925.

Illumination

Year's Progress in Lighting.—This review, prepared by the committee on production and application of light, was presented at the Saratoga convention of the A. I. E. E. An outline of its contents may be found in the

ELECTRICAL WORLD report of the convention (July 4, 1925, on page 14).—*Journal of A. I. E. E.*, October, 1925.

Motors and Control

Electric Motor in the Crushed-Stone Industry.—E. W. PILGRIM.—The article contains a description of applications of electric motors, in general of comparatively large size, to quarrying and crushing. The electrically driven equipment includes well drills, shovels, locomotives, crushers, screens, conveyors and miscellaneous equipment, in addition to lighting. On these various items the author gives a considerable quantity of data and suggestions as to the most suitable drive and electrical equipment to be used under certain conditions encountered in practice.—*General Electric Review*, November 1925.

Heat Applications and Material Handling

Steam and Electric Shovels in Open Mine Excavation. — Quoting from a paper by H. C. Goodrich in *Mining and Metallurgy*, the statement is made that for open-pit excavation on the property of the Utah Copper Company, at Bingham, Utah, the adoption of electric power shovels has been justified economically. Two such shovels have been in use for about a year, one being driven by alternating, the other by direct current. The all-around desirability of either cannot yet be determined. In power consumption per cubic yard the alternating-current exceeds the direct-current by about 10 per cent. — *Engineering News-Record*, Oct. 8, 1925.

Evolution in Oil-Line Pumping Equipment. — WILLIAM N. BEADLE.—Comparisons are instituted between steam-driven reciprocating-pump units and electrically operated centrifugal pumps in the oil pipe-line service in California. Low cost of maintenance, reduction of pipe-line resistance by elimination of pulsations in the flow, simplicity of control and reduction of fire hazard are points favoring electric drive. Data are given on several installations and on operating conditions.—*General Electric Review*, November, 1925.

Electrophysics, Electrochemistry and Batteries

Magnetic and Electrical Properties of Cast Iron.—J. H. PARTRIDGE.—An abridgment from a paper presented at the Iron and Steel Institute meeting, Birmingham (England), September 9 and 10, of the result of an investigation in which the effects of annealing and of the presence of alloys were studied. The highest magnetic induction and permeability were obtained with cast iron which had been annealed. In the extreme case the induction was increased 70 per cent and the maximum permeability tenfold on annealing. In the cast state silicon decreases the induction, except perhaps at low flux densities, as was shown by a sample containing 6.04 per cent silicon, 0.09 combined carbon and 2.52 graphitic carbon, which had a permeability of more than 1,000 at a field strength of 2.0 gausses. In both the cast and annealed conditions silicon reduces the coercive force and the hysteresis loss. Also, in both conditions manganese, nickel and chromium are prejudicial to high magnetic induction. The effects of aluminum are very diverse, depending on the quantity present. In the annealed condition in amounts up to 1 per cent it decreases the induction and permeability. When present in amounts from 1 to 3 per cent it causes a huge increase in these properties, certain specimens showing inductions of over 13,000 c.g.s. units and permeabilities of over 1,000, with greatly decreased coercive force and hysteresis loss. The effects of phosphorus and cobalt were also included in the investigation.—*Engineering* (*England*), Sept. 25, 1925.

Thermo-Electric Effect in Single-Crystal Zinc Wires.—ERNEST G. LINDER.—Crystals were prepared by drawing each in the form of a wire through a 2-mm. hole in a mica disk which floated on a surface of molten zinc. They were then split along the basal plane normal to the vertical axis. The orientation—i.e., the angle between this axis and the axis of the wire—depends on conditions in the drawing. It was found that the thermo-emf. increases with temperature, but more rapidly than in linear relation; also, that the emf. with larger angles of orientation exceeds that with smaller angles, so that with a circuit of differently oriented crystals the emf. is directed, at the hot junction, from the crystal of higher to that of lower orientation. Curves are given showing the emf. to copper for various temperatures and orientations.—*Physical Review*, October, 1925.

Traction

Four 200-Hp. Motors on Articulated Cars.—CLARENCE W. SQUIER.—The end trucks of each articulated car recently placed in service by the Brooklyn-Manhattan Transit Corporation have two driving motors, making a total of four motors per car. The pivot trucks are idlers. Technical data, a control diagram and a number of views of details accompany a description of the electrical equipment.—*Electric Railway Journal*, Oct. 13, 1925.

Application of Electric Propulsion to Double-Ended Ferryboats. — A. KENNEDY, JR., and FRANK V. SMITH.—Tests on double-ended ferryboats, which are the accepted type of vessel for that class of service, have shown that the power consumption for propulsion is a minimum when pushing with the rear screw, the forward one being removed. When both propellers are driven at the same speed, the power rises by about 25 per cent; when the bow screw is driven at a speed corresponding to neutral thrust, the rise in power consumption is only about 5 per cent. It is impracticable to remove a screw, but with electric drive the last-named method becomes possible. The gain in thermal and propulsive efficiency more than compensates for the electrical losses. In addition, electric drive has the advantage of more rapid maneuvering and, with some systems, of direct control from the pilot house. The authors have assembled test data on boats with several kinds of drive, including direct-connected reciprocating-engine, turbine-driven alternator with two-speed induction motors, Diesel-electric with direct-current motors and geared turbine-electric, direct current, both of the latter having Ward Leonard control.—*Journal of A. I. E. E.*, October, 1925.

Telegraphy, Telephony, Radio and Signals

Some Problems of Broadcast Reception.—G. W. O. HOWE.—Under the general head of "Notes on Wireless Matters" the author calls attention to the incompatibility of the conditions for sharpness of tuning and quality of reception. These were recently pointed out by Captain H. J. Round. The former condition requires a circuit having small resistance, i.e., low decrement. Good quality demands response over a frequency band of appreciable width and calls for a relatively high decrement. The width of the band depends on the wave length; for a 400-m. wave it amounts roughly to 1 per cent on each side of the carrier frequency. A decrement sufficient for this width permits objectionable disturbance from a station detuned by as much as 10 per cent. A method of approaching the ideal consists in the use of several loosely coupled circuits in cascade. Equations are given for conditions whereby such circuits can be designed to give good response over the desired band, though with increased detuning the current falls off rapidly.—*Electrician* (*England*), Sept. 11, 1925.

Report on Measurements Made on Signal Strength at Great Distances.—H. J. ROUND, T. L. ECKERSLEY, K. TREMELLEN and F. C. LUNNON. — This exhaustive paper of nearly seventy pages, with 119 figures consisting of maps, charts and diagrams, contains the results of studies on signal strengths from stations in Europe and America made during a voyage from England to New Zealand in 1922 and 1923 by way of Panama, returning after transshipment of the equipment to Australia by the Red Sea-Mediterranean route. Among the phenomena observed was the blurring of signals from New York when the vessel was in the Pacific at a distance of some 12,000 km., as received on a plain vertical antenna, though they were quite readable by a unidirectional receiver but were found to come from the southwest instead of the northeast. Similar reversals appeared toward the Antipodes from other stations. When transmission necessitated that the waves follow the great circle through the north and south poles no signals were received. Among the matters investigated were the variations of signal field intensity with distance, day and night transmission, "beats" due to reception over two paths, bearings of signals, attenuation and atmospherics. The field intensities and attenuations as found are compared with the values computed from theoretical or empirical formulas. — *Journal of I. E. E.*, October, 1925.

News of the Industry

Shoals Reports Still Held

Minority Document Unexpectedly Delayed in Reaching President—Release Expected Soon

BOTH the majority and minority reports of the Muscle Shoals Commission will be submitted to Congress, it has been announced at the White House. Prior to that time, however, it is expected that the two reports will be released for publication. Statement last week to the effect that the minority report had been submitted proved to have been erroneous. It is understood to have been the intention of Commissioners Curtis and McClellan to submit the report about the middle of the week. When on the point of taking it to the White House, it now develops, the report was taken up for a final word of discussion with one of the Cabinet officers with whom the President asked the commission to confer in the formulation of the report. This conference was prolonged unexpectedly in an effort to reconcile certain views of the administration with those of the minority members of the commission. This effort is understood to have been unsuccessful. As this is written, the delivery of the minority report is expected hourly.

Michigan City, Ind., to Have 60,000-Kw. Station

Construction of a large generating station on the lake front at Michigan City, Ind., will be started by the Calumet Gas & Electric Company early next spring. The plant is scheduled to be placed in operation in August, 1927. It will have an initial capacity of 60,000 kw., composed of two 30,000-kw. units, but will be designed to accommodate additional and larger units as they are needed. The turbines are now being built by the Westinghouse Electric & Manufacturing Company. The first section of the station will represent an investment exceeding $6,500,000.

Erection of this station is another important step in the development program being carried on in northern Indiana by the operating subsidiaries of the Midland Utilities Company, of which Samuel Insull is president. Power generated in the Michigan City station will be carried both east and west over a 132,000-volt line to substations where it will be reduced in voltage for distribution over the systems of the Calumet Gas & Electric Company and the Northern Indiana Gas & Electric Company, both subsidiaries of the Midland Utilities Company. The energy will also be sold to other utility companies and used in the operation of the Chicago, South Shore & South Bend Railroad, which is also a subsidiary of the Midland Utilities Company. From Michigan City a line extension to the La Porte-St. Joseph County line will, as already reported, tie in with the American Gas & Electric system.

The station, which is being designed by Sargent & Lundy, is to be unusually attractive architecturally and part of the grounds will be made into a landscape park. The building will be of brick and Indiana limestone in a semi-Gothic style.

Work on Green Bay Plant to Begin at Once

The Wisconsin Public Service Corporation has definitely decided to start construction work at once on its two-million-dollar steam-electric generating station at the junction of the Green Bay and Fox Rivers, according to J. P. Pulliam, vice-president and general manager. This plant, which will be constructed by the Byllesby Engineering & Management Corporation, will have an initial capacity of 20,000 kw. in two units of equal size. Ample water supply for boiler-feed and condensing purposes will be available not only for the contemplated initial installation but for a plant of much larger size, for the station will be so constructed that enlargements and additions may be made economically as the need for additional capacity becomes evident.

The new plant will be interconnected with the six hydro-electric and three other steam plants of the corporation, which have a total capacity of approximately 60,000 hp. This aggregate rating will be increased to 98,600 hp. when the Green Bay steam plant and Sandstone Rapids power projects are completed. There will then be four steam plants and seven hydro-electric plants developing power.

State Supreme Court Overrules Pinchot

Declares His Dismissal of Public Service Commissioners Illegal and Restores Ejected Men to Office—Governor's Next Move Uncertain

DECLARING constitutional a section in the law establishing the Public Service Commission of Pennsylvania which provides that removals from membership in that body may be made by the Governor, "by and with the advice and consent of the Senate," for inefficiency, neglect of duty or misconduct, and that the accused shall be furnished with a copy of the charges and have an opportunity to defend himself at a public hearing, the Supreme Court of Pennsylvania on Monday of this week overruled Governor Pinchots' recent action in summarily dismissing Commissioners James S. Benn and S. Ray Shelby from office and restored them to the posts from which they had been ousted, awarding them back pay.

When the Pennsylvania Governor dismissed the two commissioners last summer he disregarded that section of the act and based his action on the constitutional provision which sets forth that appointive officers other than judges of the courts of record and the Superintendent of Instruction may be removed at the pleasure of the power appointing them. The Governor explained his action by saying that the commissioners he sought to remove were out of sympathy with the public.

The State Supreme Court held, in effect, that the Legislature has the power to dictate the manner in which the Chief Executive may wield the power conferred on him by the constitution, and to make the commission an arm of the Legislature and not a creature of the Governor. Whether Mr. Pinchot will now attempt to remove the commissioners by making charges against them in the manner prescribed had not been made evident when this was written, the Governor refusing to indicate his plans. Nor had a determination yet been expressed to take the case to the United States Supreme Court, though there is said to be a possibility that this will be attempted.

New Southern Power Steam Plant Will Be on Yadkin

The Yadkin and not the Catawba River is to be the site of the new steam plant announced some time ago as in contemplation by the Southern Power Company. The company will, according to official statement from Charlotte, N. C., immediately proceed to erect a 75,000-kw. plant on the first-named river two miles from the city of Charlotte.

A part of the machinery for the plant has already been purchased, it is announced, and a part of the building organization is already on the grounds. There will be two turbo-generators of General Electric make. The new plant will be pushed to rapid completion. With its inauguration the Southern Power Company will have added 210,000 hp. to its generating capacity since the beginning of the present year. This includes the Fort Mill and Rhodhiss hydro-electric plants on the Catawba. The former, rated at 70,000 hp., is nearly completed. The latter, rated at 40,000 hp., was finished last March, but the drought has thus far made it impossible to utilize more than a small part of its capacity. The new steam plant, operating as a reserve, will, the company confidently declares, make a recurrence of the drought conditions of this year impossible.

Water-Resource Survey

Why American Engineering Council Is for Nation-Wide Investigation by Geological Bureau

IMPRESSIVE support has been marshaled by the American Engineering Council for its bill proposing a complete inventory of the nation's water resources, which is to be introduced at the approaching session of Congress. The wide interest displayed in the subject and the fact that a report on a general survey of rivers will be made to the Congress insure at least committee consideration of the matter.

On behalf of the legislation which has been drafted by the American Engineering Council it will be argued that the United States Geological Survey for more than thirty years has conducted systematic surveys of water resources and is the best fitted government agency to undertake the proposed work. The methods and instruments developed by the Survey for conducting these investigations have been accepted as standard throughout the world, it is claimed. It will be contended, in addition, that the Geological Survey is primarily a bureau of research and investigations that collects data systematically and publishes them for general information and use, while the sporadic investigational work with respect to water resources done by other government bureaus is commonly intensive rather than extensive, being undertaken for the benefit of specific local projects.

Congress has made specific appropriations for water-resource investigations by the Geological Survey since 1895, and the extension of these investigations to meet present demands requires that these specific appropriations be enlarged. Funds collected from licensees of the Federal Power Commission or from other sources are not available for these investigations.

As a result of specific appropriations, the Geological Survey, with its limited funds, has already collected records of flow of over 5,000 gaging stations on the principal rivers of the United States. Data for more than 25,000 record-years are available for these stations. Surveys covering over 16,000 miles of river channel have been made which show by contours the principal topographic features along the rivers and detail topography of reservoirs and power sites.

The Chief of Engineers and the secretary of the Federal Power Commission are expected to oppose the bill, which, as previously explained, conflicts with the desire of that commission to obtain from Congress authorization to make a similar survey, using for that purpose the fees paid by its licensees.

W. B. Foshay Buys a Power System in Nebraska

Announcement is made at Minneapolis of the addition by W. B. Foshay & Company of 130 miles of electric transmission lines in Nebraska to the territory now served by the company. These lines are valued at $750,000, and by their acquisition the Foshay interests will add twenty communities to those it serves with electricity as well as take over four small hydro-electric plants at Valentine, Long Pine, Ainsworth and Atkinson.

When a new line now under way is entirely completed the Foshay companies will have a solid connection from Mountain Lake, Cottonwood County, Minn., south to Sioux City and west from Sioux City to Valentine, Neb. The project will make use of the power of the Niobrara River, which heretofore has gone to waste.

In addition to the Nebraska development, the Foshay interests recently took over the property of the Crescent Electric Company of Hennepin County, which serves many points at Lake Minnetonka with electric power.

The W. B. Foshay Company controls the Tri-States Utilities Company, the People's Light & Power Company, the Minnesota Electric Distributing Company, the International Public Service Corporation and the Bemidji (Minn.) Electric Company. Through these subsidiaries it supplies electric power to 142 towns and cities in Minnesota, North Dakota, South Dakota, Iowa, Nebraska and Wisconsin.

New England Power Reorganization Plan

Rearrangement of Financing Announced—Twenty Millions in New Money to Be Furnished by Participating Interests for Enlargement Undertakings

THE trustees of the New England Company, which controls the hydro-electric system generally known as the New England Power System, have just announced the plan of enlargement and reorganization to which reference has lately been made in the ELECTRICAL WORLD in connection with the participation of various financial and operating groups in the development of this set of properties. The plan is the result of negotiations extending over a number of months which have culminated in a contract between the New England Company and interests affiliated with the International Paper Company, with the Power Corporation of New York and with Stone & Webster, Inc., under which the new interests will supply $20,000,000 additional capital to the company as a part of the plan if it receives the approval of the stockholders.

The broad features of this plan are (1) a rearrangement of the present capitalization of the company, (2) the addition of new money, and (3) the expectation that the refinanced company and the new interests will enter into arrangements looking to the sale and interchange of electric power between them.

1. Present shareholders will receive (a) for each share of present first preferred one and one-tenth shares of new 6 per cent preferred, (b) for each share of present first preferred with additional dividend rights attached one and one-sixth shares of new 6 per cent preferred, (c) for each share of present participating second preferred $115.50 of the new 6 per cent preferred and seven-tenths of a share of new common, and (d) for each present common share $165 of new 6 per cent preferred and one share of new common. A par value of $100 is at present assumed for the new preferred, which will be non-voting except in special cases. The new common shares will be without par value.

Present first-preferred and participating second-preferred shareholders who do not assent to the plan will, except as affected by certain capitalization changes mentioned in the trustees' letter to stockholders, remain undisturbed, unless a method of carrying out the plan is adopted that involves a liquidation of the company, in which case such non-assenting shareholders will be entitled to cash at par and accrued dividends.

Upon completion of the plan the basic capitalization, including the new money and assuming the assent of all the present stockholders, will be 237,533 shares of new 6 per cent preferred, to be issued to the present shareholders of the company, and 520,381 shares of new common, of which present shareholders will receive 120,381 and the new interests will subscribe for 400,000. An additional issue of not over 16,666 shares of new 6 per cent preferred shares is also proposed to pay for certain rights owned by the Deerfield Company to buy and sell power from and to the system, dating back to its beginnings.

2. Twenty million dollars will be available by installment subscriptions to 400,000 common shares at $50 per share. Of these, the International Securities Company, affiliated with the International Paper Company, has agreed to subscribe for 86,667 shares, interests identified with the Power Corporation of New York for 173,333 shares, and Stone & Webster, Inc., for 140,000 shares, payable in installments. It is agreed that Stone & Webster, Inc., may substitute for its own subscription other subscribers acceptable to the company, with corresponding reduction and apportionment of obligations. It has already been announced in the ELECTRICAL WORLD that the Edison Electric Illuminating Company of Boston, the Hartford Electric Light Company, the Connecticut Power Company, the United Electric Light Company of Springfield, the Turners Falls Power & Electric Company and the Blackstone Valley Gas & Electric Company of Pawtucket, R. I., will share in the participation.

3. The new interests own or control water powers, and under the plan it is expected that the company will from time to time enter into arrangements with them for the purchase and interchange of power, although no definite arrangements are at present being entered into. It is believed that such arrangements will be of particular

benefit to the New England Company, enlarging the scope and value of its service in the territory served by it.

The water-power rights of the company at Bellows Falls on the Connecticut River are to be sold to interests affiliated with the International Paper Company on the basis of cost plus net operating and carrying charges and simple interest. This will consolidate in one ownership all rights necessary to an economical development, the output of which it is expected will be purchased and used by the system.

Owing primarily to questions of taxation, the exact method of procedure for carrying out the plan, whether solely through the present company or by a sale of its assets to a new voluntary association whose shares will go to present shareholders and new subscribers, or by a combination of these methods or some other method, has not yet been decided upon and will be determined by a committee, referred to below. The company's shares are at present exempt from Massachusetts income tax, but as the percentage of holdings outside the state will be greatly increased under the new set-up, to continue this feature would result in a much heavier tax upon the company than the Massachusetts residents would themselves pay, and it is therefore proposed to change that feature; but the new preferred shares will be made tax-refund in Massachusetts under provisions easy of operation so that the effect in income or convenience of the change on holders of such new preferred shares will be negligible.

The committee formed to carry the plan into effect consists of William A. Brooks, treasurer New England Company, Boston; Charles A. Harris, treasurer Brattleboro (Vt.) Savings Bank, and Arthur H. Lowe, president Amoskeag Manufacturing Company, Fitchburg, Mass. Proxies, assents and agreements are being sent to Mr. Brooks, and stock certificates are to be deposited with the Old Colony Trust Company, Boston. A special meeting of stockholders will be held in Boston December 14 to consider and act upon the plan.

Chairman Magrath for Taking More Power from Falls

Addressing a large number of engineers who gathered in Toronto recently to show approval of his appointment, C. A. Magrath, new chairman of the Ontario Hydro-Electric Power Commission, asserted that the purpose of the commission was the development of the available water resources, internal and international, to meet the country's expanding power requirements, rather than the construction of steam plants. Mr. Magrath said he had not been long enough in charge of the task laid down by the late Sir Adam Beck to speak with the weight of experience, but he felt that the present was no time to go in for steam plants. He felt that the great development enterprise proposed by Ontario on the St. Lawrence could be carried out without injury to the people of the United States or to the Province of Quebec.

The new chairman also put forth the suggestion that still more power could be developed on the Niagara River without lessening the scenic beauty or injuring navigation either above or below the falls. When 56,000 cu.ft. per second was decided upon it was largely an experimental amount, he said, and he believed it was the opinion of most engineers that a greater amount could be taken without injury. He would advise this course for a few years, at least until power supplies could be drawn from other sources. This new power could be divided between the two countries, and he could see no reason why the engineers of Canada and the United States could not get together and work out a new Niagara power plan.

Street-Lighting Tables for 1926

FOLLOWING its practice for thirty-seven consecutive years, the ELECTRICAL WORLD has prepared tables showing the proper time for lighting and extinguishing street lamps. The tables for 1926 are now ready, and a copy of them will be sent free to any subscriber upon request to ELECTRICAL WORLD, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 25 cents each is made to cover a portion of the postage, printing and compilation costs.

More Power Demanded

Los Angeles Chamber of Commerce Committee Looks to Colorado River for It

STRESSING the rapid increase in demand for power in southern California and urging that immediate steps be taken to procure additional energy through the development of the Colorado River, the report prepared for the citizens' water and power committee of fifteen of the Chamber of Commerce of Los Angeles has been made public. This report was prepared by L. S. Ready, chief engineer of the California Railroad Commission, and H. G. Butler, power administrator for the state in 1920 and 1924. Briefly stated, the report makes the following recommendations:

1. The demand for electrical energy in Southern California is increasing at such a rapid rate that immediate steps should be taken by those responsible for the power supply toward obtaining developments on the Colorado River.

2. There should be no difficulty on economic waste under co-ordinate development in the absorbing of the power to be produced from the proposed Boulder Canyon development when this shall become available.

3. Energy from the Colorado River is the cheapest hydro-electric energy that can be obtained for southern California.

4. The steam plants of the Edison company are adequate to furnish standby service to the city until 1927.

5. Two additional interconnection points should be made between the Southern California Edison Company and the Bureau of Power and Light of Los Angeles.

6. The Bureau of Power and Light should have steam standby service under its own control. A unit of 25,000 kw. should be available by 1927.

New Generating Station at Columbus, Ohio, Advancing

Work on the new steam generating station of the Columbus (Ohio) Railway, Power & Light Company on the Scioto River just south of the city has progressed to a point indicating that the initial 60,000-kw. installation will soon be in service. The eventual rating of this station will be 150,000 kw., which, added to the 84,000 kw. in the company's existing stations, will give it a capacity of 234,000 kw. The station will be known as the Picway power station. Virtually the entire electric light and power business in Columbus and its vicinity as well as the street railway business is done by the company, which in the last ten years has seen an increase of 391 per cent in energy sold and 237 per cent in number of customers.

Topics for Annual Meeting of Mechanical Engineers

Among papers to be presented before the American Society of Mechanical Engineers at its annual meeting in New York City are the following:

Tuesday Morning, December 1.—Wood Industries Section: "The Electric Molder," A. Jensen, Jr.; "High-Speed Induction Motors and Frequency Changes," Charles Fair.

Afternoon.—Power Division: "Value of Higher Steam Pressures in the Industrial Plant," William F. Ryan; "The Supply of Industrial Power," W. H. Larkin, Jr.

Wednesday Morning, December 2.—"Materials-Handling Problems and Their Solution," Frank D. Campbell; "Springs for Electrical Measuring Instruments," B. W. St. Clair.

Thursday Morning, December 3.—Power Division: "Radiation in Boiler Furnaces," B. N. Broido; "Recent Developments at Colfax Station," C. W. E. Clarke; "Steam Bleeding and Turbine Performance," C. D. Zimmerman; "Development of a Unit Pulverizer," R. Sanford Riley and O. Craig.

Afternoon.—"Furnace Refractories," E. B. Powell.

On Tuesday afternoon Secretary Hoover will deliver the Henry Robinson Towne lecture on engineering and economics, and on Friday afternoon Dr. Zay Jeffries of Cleveland will give the Robert Henry Thurston lecture on engineering and science.

Eighty Thousand Visitors to Power Show Expected

Arrangements have been completed to care for the eighty thousand visitors expected to attend the fourth Power Show in the Grand Central Palace, New York City, during the week beginning November 30. The exposition will include exhibits from more than four hundred manufacturers and will be much more complete than its three predecessors. Lectures will be given on various topics, and these have been arranged to avoid conflict with the programs of the A. S. M. E.

Promoter Sees Vast Power from Texas Panhandle Gas

As a substitute for expensive hydro-electric and irrigation projects on the Colorado River it is proposed by a group of citizens of Texas and New Mexico that the natural-gas supply of the Panhandle be utilized for generating electricity to supply light and power within a radius of 500 or even 1,000 miles. John W. McGee of Roswell, N. M., who recently made a complete survey of the natural-gas resources of the Panhandle, is taking the lead in promoting the construction of electric power plants in the natural-gas region near Amarillo. He says:

"I figure that there are a thousand square miles of gas territory already proved and all the gas in this area has a uniform rock pressure. My study of the potentialities of the field is that it will be able to supply 4,000,000 hp. for at least one hundred years. The gas area of the Panhandle has 3,600 square miles. East to west the field has been defined from Shamrock to Channing and 30 miles from north to south. Estimating that each of the 3,600 sections embraced in the territory might support one good well and allowing a deduction of one-fourth in the production of each well, 36,000,000,000 cu.ft. of gas is available in this territory. But, figuring on the use of only 9,000,000,000 cu.ft. daily, at least 4,000,000 hp. can be produced in this area to every billion feet, or a total of 36,000,000 hp."

Mr. McGee puts the cost of the natural-gas power enterprise he favors at $65,000,000 and that of the contemplated developments on the Colorado at $1,250,000,000. "The utilization of the Panhandle gas supply at a cost of one-twentieth that of the Colorado River project," he declares, "would produce more energy for a greater number of people and hasten the development and population of an area potentially fertile and confronted with vast opportunities." Mr. McGee quotes the late Dr. Steinmetz in support of the statement that it is practicable to transmit electricity through high-tension transmission lines for a distance of 2,000 miles from central generating plants, and points out that within a radius of half that extent there are twenty million people.

Large Plants Projected for Brazos River

Following a joint survey of dam and water-storage reservoir sites on the Brazos River just made by the United States Geological Survey and the State Board of Water Engineers, formal approval of the project is under consideration. The site of the largest of these proposed dams is in the Dog Bend of the Brazos River, 7 miles from Mineral Wells. In connection with the project the construction of a large hydro-electric plant is proposed. The dam would be 215 ft. in height, with water but 200 ft. deep. It would store more water than could be used for irrigation, though 75,000 acres could be abundantly watered. The rough country would make it impossible to serve more than this amount. Irrigation, power generation and flood control would be effected by such a dam.

A second dam site in a 250-ft. canyon at Inspiration Point, above the town of Brazos, also was located. It could be but 50 ft. high because the backwater would reach the bigger dam. Still another desirable site was located on the Brazos River in Decordova Bend, adjacent to Hood County. The bend is 23 miles in length and the distance at the neck but half a mile. The fall in the bend is 30 ft., and with the proposed 70-ft. dam a total of 100 ft. would be had for irrigation, power and storage.

An additional site is being surveyed near Kopperl, between Somervell and Johnson Counties, which would provide another reservoir. Entire control of Brazos River floodwaters would be effected by the large dam or by a combination of smaller dams at the points indicated.

Radio as a Means of Communication Between Stations

With its general offices in Oklahoma City and power plants at Lawton, Okla., and Quanah, Tex., about 65 miles and 150 miles respectively away, much difficulty in maintaining communication has been experienced by the Southwestern Light & Power Company in times of storm during the early spring. According to President Earl R. Ernsberger, a remedy has been sought and found in radio. Three broadcasting and receiving stations have been established at the three cities named, which are now operating under experimental license, but for which a wave length will be assigned by the Department of Commerce, and one expert is employed full time and two part of the time in operating the system. At present private and positive communications are exchanged in code form, regardless of the weather. Very soon it is expected that radiophone equipment will also be installed, permitting either the voice or the code to be used.

Private telephone lines extend from the three stations to other points on the system, none of which is more than forty-five mniutes' drive from one of the three radio posts. Mr. Ernsberger is quoted as maintaining that the radio plant is better than a telephone system over the company's high-tension lines. The initial investment he puts at about $6,000. Operating costs are comparatively small. In 1922 the company had only 86 miles of high-tension line, serving eight communities. Today 311 miles of line reach thirty communities.

Industrial Museum for New York City Advocated

An industrial museum for New York City was advocated at a testimonial meeting held in that city this week, in the Engineering Societies Building, in honor of Dr. Oskar von Müller, director of the Museum of Industries and Science in Munich. The meeting was held under the auspices of a group interested in establishing a similar institution in America. Dr. George F. Kunz presided and made an address in favor of the plan. Other speakers were John W. Lieb, vice-president New York Edison Company; Dr. John Van W. Reynders, president of the American Institute of Mining and Metallurgical Engineers, and Dr. Charles L. Reese. A telegram from Samuel Insull was read expressing hope for the speedy construction of the contemplated museum.

Terminable Permit Law for Illinois Opposed

Meeting in Decatur last week, the Illinois Municipal League heard determined attacks upon the Barr bill, the terminable-franchise measure for utilities which is to come before the Illinois Legislature. Francis X. Busch, Corporation Counsel for Chicago, attacked the bill, but said it had redeeming features. J. Nick Perrin, City Counsel for Belleville, was opposed to any sort of terminable-permit law, declaring: "The duration of the permit depends on the nature of the grant and the conditions under which it may be terminated and the power of the city or other controlling agency to meet the conditions imposed in event of such termination. It may in effect be terminable or it may for all practical purposes be a perpetual franchise."

Willis J. Spaulding, Commissioner of Public Property of Springfield, declared that "furnishing electricity is a public function" and read statistics to show that the municipally controlled electric plant in Springfield saved consumers $1,836,000. He attacked what he described as the "propaganda bureau of the private power interests, organized to discredit publicly owned electric plants."

Electrical Credit Men Favor Local Chapters

Assembling in Chicago on November 19 and 20 for its thirtieth annual meeting, with three hundred in attendance, the Central Division of the Electrical Credit Association recommended for action by the executive committee that "in each center where a number of our members are domiciled there be established local chapters of the association — for example, the Cleveland Chapter of the Electrical Credit Association, Central Division—these organizations to take the place of the 'moral risk' clubs which have been operating in the same centers for many years."

Addresses on matters pertaining to credit were made by C. H. Crennan, of the Continental and Commercial National Bank; Stephen Love, of the Northwestern University Law School; O. J. Matthews, of the London Guarantee & Accident Company, and Laurence W. Davis, general manager Association of Electragists. Miss C. B. Conklin, Miss J. M. Cleveland and Mrs. E. A. Henderson Beck discussed the part that has been and that might be taken by women in credit work.

These officers were elected: President, A. V. Willett, Western Electric Company, Chicago; vice-president, J. V. Painter, Appleton Electric Company, Chicago; secretary-treasurer (re-elected), F. P. Vose.

Before the Federal Power Commission

The Federal Power Commission has issued a preliminary permit to the South Colorado Power Company covering a project on Great Creek near Canon City, Col. Two dams are to be constructed. One will create a reservoir containing 97,000 acre-feet. The other reservoir will contain 15,000 acre-feet. While only 3,200 hp. of primary power will be developed, it is planned to install 13,500 hp.

The Montana Power Company of Butte has applied for a license covering a transmission line 93 miles long from its substation near Billings to the Northwestern Improvement Company's coal mine on the Crow Indian Reservation. In addition, the line will supply power for public utility use in the town of Hardin.

The Iron Mountain Mining Company of Superior, Mont., has applied for a license covering a transmission line 4 miles long from Superior to the concentrating plant of the applicant.

The Utah Power & Light Company has applied for a license covering its constructed project on Alpine Creek in Utah County.

The license covering the project of the Nevada Irrigation District on the Yuba River in Nevada County, Cal., has been signed and delivered. This gives full rights for the use of the waters of the stream for the irrigation of agricultural lands. Incidental to the irrigation 20,000 hp. of primary power is made available at the plants of the Pacific Gas & Electric Company, the revenue for which makes possible the agricultural development.

The Board of Supervisors of Winnebago County, Ill., has filed a protest with the commission against power development in Rock River as planned in the application of George B. McClary. The board gives no details as to why it objects to the development other than to say that it would jeopardize "the safety and health of the people." Mr. McClary desires to erect three dams in the river, but small storage is involved.

Puget Sound Company Adds to Its Territory

Acquiring about 90 miles of transmission line and other electric light and power property in the Olympic peninsula from the Northwestern Power & Manufacturing Company of San Francisco, the Puget Sound Power & Light Company has added Clallam, Jefferson and Kitsap Counties to the fifteen western and central Washington counties in which it already operates, according to an official announcement made by William H. McGrath, vice-president of the company. The property changing hands consists of a transmission line beginning at Port Angeles and extending through Sequim to Bremerton Junction, about 7 miles southwest of Port Townsend. From this point a branch line goes to Port Townsend, while the main line continues south, crossing Hood's Canal at Port Gamble and passing through Poulsbo and Keyport to Bremerton. Possession of the property will be taken by the Puget Sound Power & Light Company December 1. The transaction does not include the hydro-electric plant of the Northwestern company situated on the Elwha River which has hitherto been supplying power to all points along the transmission line just described. Under the purchase agreement the Northwestern company will continue to supply power from the Elwha plant until such time as the Puget Sound company shall have completed its submarine cable connection with the big mainland plants.

The towns of Port Angeles, Sequim, Silverdale and Poulsbo and the North Pacific Public Service Company, supplying Bremerton, which have hitherto been wholesale customers of the Northwestern company, will after December 1 be wholesale customers of the Western Washington Power Company, a subsidiary of the Puget Sound Power & Light Company. Extensions and improvements are promised by Mr. McGrath.

Briefer News

University of Oklahoma Offers Utility Administration Course.—The president of the University of Oklahoma announces that a four-year course in the School of Business, to be entitled "public utility administration," will begin with the scholastic year 1926. This decision follows two years' effort by the Oklahoma Utilities Association.

Saylorsburg (Pa.) Light & Power Absorbed.—The absorption in the General Gas & Electric Corporation's Pennsylvania-New Jersey system of the Saylorsburg Light & Power Company is announced. This company, serving Monroe County, has operated a small hydro-electric plant besides purchasing power from the Pennsylvania Edison Company.

Chickasha Gas & Electric Buys Carnegie Hydro Plant.—The Chickasha (Okla.) Gas & Electric Company has purchased the plant of the Carnegie Water Power Company, supplying electric light and power at Carnegie and selling energy wholesale to Fort Cobb. The Carnegie Water Power Company has both a small hydro-electric plant and a small steam plant.

Iowa State College Experiments with Windmill Generators.—The agricultural engineering faculty at the Iowa State College at Ames, Iowa, is experimenting with wind as a source of farm

Lighting the New Bridge Over the Susquehanna at Clark's Ferry

A NEW ornamental half-mile-long concrete bridge across the Susquehanna at Clark's Ferry, near Harrisburg, Pa., supplanting one built ninety-seven years ago, is a source of much local pride and will carry the traffic of two national highways in addition to that originating in its neighborhood. Illuminating fixtures rated at 12,000 watts in all were recently installed. They are of Westinghouse make and were designed by Prof. Paul P. Cret of the University of Pennsylvania. A special Westinghouse lantern was adopted and incorporated in the design of each of the light bases for the respective arches and abutments at the bridge approaches. The lighting is so brilliant as to permit automobiles to cross at night with their headlamps shut off.

power. A windmill on top of a 100-ft. steel tower with the generator attached produced 200 kw.-hr. in thirty days. The velocity and distribution of the wind were declared to be the determining factor, according to Fred C. Fenton, in charge of the experiment.

Two Voters Prefer Municipal Plant to Private Service.—At a special election held at Winfred, S. D., to decide the question of selling the municipal electric light system and granting a franchise to the Dakota Public Service Company, the proposal carried almost unanimously, there being only two votes against it. The Dakota Public Service Company operates seventeen light plants and telephone exchanges in South Dakota towns.

Hattiesburg and Laurel, Miss., Now Interconnected.—That section of the Mississippi Power Company's transmission line connecting its plants at Hattiesburg and Laurel was completed and placed in service last week, according to President Barney E. Eaton. This line is a section of the 110,000-volt line which will bring hydro-electric power into Meridian, Laurel, Hattiesburg and adjacent communities and which is being constructed from both directions by separate forces. Through hydro-electric power service from the Southeastern interconnected system will be transmitted from the Alabama state line as soon as the Mississippi line is completed, and the Mississippi Power Company's entire schedule of hydro-electric power rates will be put into effect. Transforming stations are under construction at Meridian, Laurel and Hattiesburg.

Emanuel Companies in Pennsylvania to Consolidate.—The Penn Central Light & Power Company, which serves Altoona, Huntingdon, Lewistown and other places in western Pennsylvania, has acquired the plants and properties of the United Lighting Company at Albion and Conneautville, Pa., and has plans under way for extensions in the spring. The companies are both controlled by the Albert Emanuel interests of New York.

Another Montana Property Is Acquired by Tacoma Company. — The power and light property at Libby, Mont., consisting of steam and hydro-electric generating stations of about 400-kw. capacity and distribution lines serving Libby, has been acquired by H. M. Byllesby & Company. It will probably be operated by the Mountain States Power Company, Tacoma, according to C. M. Brewer, vice-president and general manager.

Duquesne Light Company Opens New Substation.—The Duquesne Light Company and the Pittsburgh Railway Company opened a new 22,000-volt substation in Pittsburgh last week to furnish power to the railways and the street-lighting system. The cost of erecting and outfitting the new station, which will take its place as the fourth unit in the South Hills power and lighting development and will relieve a portion of the load of the other three units, was approximately $500,000.

Cleveland's Belt Transmission Line Nearly Complete.—The Cleveland Electric Illuminating Company's transmission-belt around Cleveland now needs for its completion only the closing of a small gap in the line being constructed between Cleveland, Lorain and Avon. This belt line, which will be one of the greatest anywhere, starts at the Lake Shore station of the company at East Seventieth Street and runs through 8 miles of tunnel to Oak Avenue, thence around a great part of the city, branching off to Lorain and Avon. The Lake Shore station, with a capacity of 291,000 kw., will be at one end of the line and the Avon station, with a capacity of 300,000 kw., at the other end.

Southern Illinois Companies Are Merged.—The Illinois Commerce Commission has authorized the consolidation of the Western United Gas & Electric Company of Aurora, the Fox River Electric Company and the Southern Illinois Gas Company under the name of Western United Gas & Electric Company. The consolidated corporation has also permission to acquire all of the property of the Aurora, Elgin & Fox River Electric Company used for light and power purposes. The new company is authorized to sell $6,500,000 of preferred stock and 200,000 shares of no-par-value common stock.

Utah Power & Light Buys Vernal Plant.—The hydro-electric plant and distribution system of the Vernal Light Company at Vernal, Utah, has been purchased by the Utah Power & Light Company. The plant, which is on Ashley Creek, serves about 600 customers. The City Council of Vernal has granted to the Utah Power & Light Company a fifty-year franchise. A number of improvements and additions to the present plant and system are contemplated for the near future.

Prizes for Electrical Plays.—Arthur Williams, vice-president New York Edison Company, is personally offering three prizes of $250, $150 and $100 respectively in a "radio play contest" for the best three plays illustrative of what electricity means to the modern American home, the action of the play not to exceed thirty minutes. A hundred dollars will be paid for each additional scenario accepted. Full particulars of the contest can be had by addressing the Edison Hour Play Contest Editor, station WJZ, New York.

Interpretation of Wisconsin's New Water-Power Act Arouses Interest.—Water-power interests in Wisconsin are watching with deep concern the legal developments in the fight between the state and paper-manufacturing companies in Appleton which are obtaining energy from dams constructed prior to the passage of the Wisconsin water-power law. In operation since 1877, these power dams must now be rebuilt, and under the water-power act the owners of the dams must agree to have the property valued and assent to selling them to the state or municipality at the end of thirty years. The paper interests maintain that the new water-power law does not apply in their case.

Guadalupe River May Soon Be Developed.—Construction of a dam across the Guadalupe River near Victoria, Tex., and the installation of an electric power plant, at a total cost of approximately $1,000,000, will, it is announced, be started soon by the Central Power & Light Company of St. Louis. The Central Power & Light Company, which was acquired earlier in the year by the Middle West Utilities Company, is the directing organization of eighteen other subsidiaries of the parent corporation.

Progress of Tri-Company Merger in Georgia and Alabama.—The merger reported previously in the ELECTRICAL WORLD as under way by which the Columbus Electric & Power Company, the Stone & Webster organization which is undertaking the Bartlett's Ferry development, would absorb the Georgia-Alabama Power Company of Albany, Ga., and its subsidiary, the South Georgia Public Service Company, is now before the Georgia Public Service Commission for authorization. It has already received the approval of the Alabama commission.

Railroad Electrification in New York City.—The Public Service Commission has approved the plans of the New York Central Railroad Company for electrification of its railroad from Spuyten Duyvil to St. Johns Park in New York City. The plans provide for the electrification of that portion from Spuyten Duyvil southerly to Seventy-second Street in the same manner as the method now employed on the electrified zone of the railroad. For the remainder of the section southerly from Seventy-second Street the company desires to use the Sieset electric locomotives. The plans proposed comply with the Kaufman act and make it possible for the railroad to begin the work at once.

Legal Delays May Retard Building of Ozark Plant. — Legal entanglements threaten to delay the construction of the Missouri Hydro-Electric Company's eleven-million-dollar power dam and plant near Bagnell, Mo. (described in the ELECTRICAL WORLD for October 31, page 917). Linn Creek, the county seat for Camden County, Mo., will be obliterated if present plans for the dam are carried through. This town is several miles above Bagnell on the Osage River, and the lake that will be formed by the dam will submerge it under many feet of water. Attorney-General Otto has held that a county seat cannot be moved except by an affirmative vote of the people of the county; that while it has been held specifically that corporations building dams and maintaining reservoirs for the purpose of storing water to generate electricity may, when authorized by statute, acquire the right of eminent domain, there is no law in

Missouri under which condemnation proceedings can be instituted. The Attorney-General says, however, that condemnation proceedings can be brought in the federal courts under certain conditions.

Opposition to Damming the Cumberland.—Fishermen and lovers of natural scenery in Kentucky are making protest against the proposed hydro-electric development of the Cumberland River at Cumberland Falls, Kentucky, "or any other project which will tend to destroy the great natural beauty of the Cumberland River." Governor Fields of Kentucky has pledged himself to do all he can to prevent the Federal Power Commission from granting a permit to the Cumberland Hydro-Electric Company of Indianapolis for the development of Cumberland Falls.

New Plant of Southern Canada Power Company Approaching Completion.—At Hemmings Falls, on the St. Francis River, in the eastern townships of Quebec Province, 350 workmen are hurrying forward the construction of the new water-power development of the Southern Canada Power Company. Work has been under way on this development since November, 1923, and, according to present indications, the 30,000 hp. to be initially installed will be available in March of next year. Power will be turned on before that date. The development will be by far the largest in eastern Canada south of the St. Lawrence River.

Fitkin Interests Acquire Virginia Northern Power.—The Virginia Northern Power Company and its subsidiary, the Virginia Northern Ice Corporation, have been purchased by the National Public Service Corporation, the Fitkin utility interests. The Virginia Northern Power Company, with headquarters at Warrenton, supplies light and power to several communities in Virginia, including Marshall, Culpeper, Remington, Rapidan, Bealeton and Orange. The system comprises three steam plants and two hydro-electric plants. Its lines will be connected with those of the Alexandria Lighting Company and the Virginia Western Power Company, which were acquired by the National Public Service Corporation earlier in the year.

Power Situation at Winnipeg.—As a result of recent negotiations between the Winnipeg Hydro-electric Department and the officials of the Manitoba Pulp & Paper Company, which has just commenced construction of its new pulp and paper plant at Fort Alexander, Man., there is a possibility that the power site at Pine Falls will be developed jointly by the city and the company on the basis of 60,000 hp. to the company and 40,000 hp. to the city. The J. D. McArthur interests now hold the lease for the water-power development, but under the terms of this the company is permitted to develop power only for its pulp-mill enterprise. The proposal is significant because if the deal goes through it will probably put an end to the still incomplete negotiations for the zoning of light and power by which the Winnipeg Electric and the civic enterprise would cease to be competitors. It would also probably mean that the city would not develop its Slave Falls site on the Winnipeg River until about 1930. The cost of the Pine Falls development, it is stated, would be $7,000,000.

Unusual Accident Arises from Flashlight Photography Near High-Tension Switchboard.—An accident from an unusual cause, but one of a kind against which generating plants should take precautions, occurred recently at the auxiliary plant of the Metropolitan Edison Company in Lebanon, Pa., where an explosion resulted in the burning and subsequent death of a man engaged in taking flashlight photographs who had just set off the seventh flash in a little more than an hour. The following statement on the unfortunate occurrence was given by Superintendent P. A. Stang to the local newspapers: "The only explanation officials of the company can offer is that this final flash of magesium powder, being very nearly 100 per cent metallic, in some way came in contact with an exposed 2,300-volt switch, causing the additional disturbance on the local system." As a result of the explosion most of the city was without electric light or power from 5.15 p.m. to 2.10 a.m.

Possible Water-Power Developments in Oklahoma. — Water-power possibilities of the Grand and Illinois Rivers in northeastern Oklahoma will be developed if two hydro-electric projects that have come before the State Irrigation and Drainage Commission are carried out, one of these projects being large and the other small. The Grand River Hydro-Electric Company announces, through Royal D. Sallisbury, engineer, that construction work probably will be started early next year on a big dam 17 miles southeast of Vinita near Ketchum. This will back up the waters of the Grand River, inundating more than 55,000 acres of land. The project will cost approximately $18,000,000, Mr. Sallisbury says. The Illinois River project is backed by Charles Page, utility manager. If the application filed with the drainage commission is granted, he has announced his purpose to build a dam 55 ft. high and 1,200 ft. long in Adair County. The project is to cost approximately $350,000 and will furnish electricity to cities and towns in eastern Oklahoma.

Plans for Development of Roanoke and New Rivers.—A company composed principally of Roanoke (Va.) capitalists has applied to the Federal Power Commission for permission to develop hydro-electric power on the Roanoke River in the counties of Roanoke, Bedford, Campbell, Franklin and Pittsylvania. Application for a preliminary permit was made under the corporate name of the Roanoke-Staunton River Power Company. The proposed installation would have a total primary capacity of 40,000 hp. There would be three dams, one at Lynville Ford, one two miles above Deerwood Ford and the third two miles above Anthony's Ford. Power is designed for use by public utilities and others. Another coming development in the same region is under investigation by a field party of the North Carolina State Department of Conservation and Development. This investigation concerns the water power of the New River, in Ashe and Alleghany Counties, N. C. The survey, William D. Harris, acting director says, is expected to show that an estimated minimum of 50,000 hp. and a possible maximum of 100,000 hp. can be had from this important stream.

Rapid Growth of Southside Virginia Power Company.—The proposed construction of hydro-electric power plants in Virginia at Brookneal and at Hyco Falls on the Dan River, at a cost of approximately $750,000, and the completion of a high-tension transmission system that will serve 12½ per cent of the state with electric power has been announced by William C. Whitner & Company of Richmond, engineers and general managers for the Southside Virginia Power Company, recently formed through a merger of the Halifax Power Company and the Emporia Hydro-Electric Company and enlarged by purchase of the Piedmont Power Company, which serves the communities of Alta Vista, Chatham and Gretna. The Southside Virginia Power Company has acquired plants at Chase City, Clover, Victoria, Crewe, Blackstone, Burkeville, Lacrosse, Brodnax and Lawrenceville and has now under construction a 66,000-volt transmission line connecting all these communities, this line being erected at a cost of $1,250,000 and being at present about 40 per cent complete. The company is owned largely by Ira and Charles T. Vaughan of Philadelphia.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

American Society of Mechanical Engineers—New York City, Nov. 30-Dec. 4. C. W. Rice, 29 West 39th St., New York.

Empire State Gas and Electric Association, Electric Section—54 West 27th St., New York, Dec. 4 and 5. C. H. B. Chapin, Grand Central Terminal, New York.

American Society of Agricultural Engineers, North Atlantic Section—Schenectady, N. Y., Dec. 10-12. Raymond Olney, St. Joseph, Mich.

Western Association of Electrical Inspectors—Hotel Sherman, Chicago, Jan. 26-28. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—New York, Feb. 8-12. F. L. Hutchinson, 33 West 39th St., New York.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

Southwestern Geographic Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Men of the Industry

Stone & Webster Field Appointments

The appointment of William B. McGorum as assistant to the general superintendent of the light and power department of the Tampa (Fla.) Electric Company is announced. Mr. McGorum was previously attached to the Boston office of Stone & Webster, Inc., managers of the Tampa property. H. E. Braunig, formerly superintendent of distribution, has been appointed superintendent of distribution and transmission of the Eastern Texas Electric Company, the Western Public Service Company and the Gulf States Utilities Company, with headquarters at Beaumont, and Harry Sharpless has been appointed superintendent of production for these companies and the Port Arthur Ice & Refrigerating Company. George B. Morgan has been appointed superintendent of the Port Arthur division of the Eastern Texas company, and P. R. Williams has been appointed treasurer of the Eastern Texas and Western companies.

Paul A. Schoellkopf, president of the Niagara Falls Power Company, sailed November 25 on board the Red Star liner *Belgenland* for a cruise around the world. Mr. Schoellkopf will visit Cuba, the Panama Canal, California, the Hawaiian Islands, Japan, China, the Philippines, Java, India, Egypt, Italy and Gibraltar.

Raymond A. Becker, who has filled the post of general superintendent of the Beloit Water, Gas & Electric Company for the past year, will be transferred on December 1 to Paducah, Ky., where he will join the Paducah Electric Company in the capacity of general manager. The efficient manner in which Mr. Becker has carried on the building program of the Beloit utility had led to his transfer to a more important post. Both these properties are now under Insull management.

C. W. Gillespie, assistant to the vice-president of the Richmond Light & Railroad Company and the Staten Island Edison Corporation since January, 1924, has resigned to enter the treasury department of the Foundation Company, with headquarters in New York City. The Richmond and Staten Island companies are under the direction of the J. G. White Management Corporation, and in leaving his former position Mr. Gillespie is severing a connection with the White interests which has covered a period of twenty years.

H. M. Saubert, who since 1920 has been local and division manager for the Consumers Light & Power Company with headquarters at Ardmore, Okla., has resigned to join the North American Light & Power Company in St. Louis, according to an announcement made by J. F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Company. The latter company recently purchased the property of the Consumers Light & Power Company, which operates in several counties of south-central Oklahoma. Mr. Saubert's resignation is due to his desire to remain with the Baehr interests, which formerly controlled the Consumers Light & Power Company and which own utility properties in St. Louis and in many other cities.

L. L. Ferree Joins New York Holding Company

L. L. Ferree, general manager of the Georgia-Alabama Power Company and the South Georgia Public Service Company, with headquarters at Albany, Ga., has resigned to join the staff of the General Engineering & Management Corporation of New York City, effective December 1. For the present Mr. Ferree will remain in Albany,

L. L. FERREE

working out an extensive expansion program for the General Engineering & Management Corporation, particularly in south Georgia and Florida.

For the past seven years Mr. Ferree has been connected with the firm of Day & Zimmermann, Inc., of Philadelphia in the capacity of general manager of several of the properties under their management. It was in the spring of 1922 that he became affiliated with the utility companies in Albany after relinquishing the managership of the Day & Zimmermann property at Salem, Ohio. He had previously spent sixteen years in Harrisburg, Pa., first in the construction department and later as general superintendent. Mr. Ferree was born in Millersburg, Pa., and was graduated from the Miffin Academy. It is probable that later he will establish headquarters in New York City.

C. F. Dobson, who has been connected with the engineering department of the Wisconsin Power & Light Company at Madison for many years, has been selected to succeed Raymond A. Becker as general superintendent of the Beloit Water, Gas & Electric Company.

Walter F. Hudson, for the past five years chief electrical engineer of the Utica Gas & Electric Company, has been appointed manager of the service division recently organized by the company. He will co-ordinate, in his position as head of this new division of the commercial department, all of the various service functions of the several departments of the company.

Dr. Edward P. Hyde returned to the United States last Tuesday after an absence of more than two years in Europe. He will visit his old headquarters in Cleveland, but he has not yet determined whether he will remain in this country or return to Lausanne, Switzerland. Dr. Hyde has been active in scientific and technical affiairs for a number of years. He organized the Nela Research Laboratories, National Lamp Works of the General Electric Company, in 1908, resigning as director in the spring of 1923 to go abroad for a prolonged rest.

H. H. Jones has been elected vice-president and general manager of the Western States Gas & Electric Company and vice-president of the California-Oregon Power Company, with headquarters at Stockton, Cal.

George P. Baldwin, general merchandise manager of the General Electric Company, has been elected a vice-president of the company, in charge of activities connected with the electrification of steam railroads, according to an announcement by Gerard Swope, president. Mr. Baldwin will be succeeded by **Charles E. Patterson**, vice-president, who will take charge of all merchandising activities of the company, including the supervision of company supply houses. Mr. Patterson will make his headquarters at Bridgeport, Conn.

Robert Wolfers, formerly connected with the Automobile Trade Directory and Chilton Automobile Directory, has joined the McGraw-Hill Company, Inc., and will be in charge of directories, lists and a direct-mail department which is being developed to serve McGraw-Hill advertisers. The McGraw-Hill Company, which publishes the McGraw Central Station Directory, the McGraw Electric Railway Directory and the Radio Trade Directory, has recently purchased the EMF Electrical Year Book and is planning to extend the directory and list services into other industries now served by the McGraw-Hill publications. **J. S. Cortelyou**, who has for the last year been devoting his time to the Radio Trade Directory, will in the future direct the compilation of all McGraw-Hill directories and lists. Mr. Cortelyou was associated for many years with Mr. Wolfers in the automotive directory business.

W. F. James, widely known in engineering circles, has been appointed district manager of the Westinghouse Electric & Manufacturing Company, with headquarters in Philadelphia. The Philadelphia district comprises the greater part of nine adjacent states. Mr. James was formerly manager of the industrial division of the Philadelphia district. He succeeds H. H. Seabrook, for the past twenty years district manager and now assigned to new duties.

Commission Rulings

Discontinuance of Unprofitable Service.—Authority to discontinue utility service operated at a loss, the Montana Public Service Commission said, in granting an application of the Barnes-King Development Company to discontinue electric service to two persons in Kendall and forty-two in Hilger, should not be denied on the ground that the utility has not applied for a rate increase if a rate which would be adequate would not be within the zone of practical application. A public utility which can operate only at an increasing loss cannot be compelled to continue such operation when it is not attempting to continue to enjoy any franchise and escape from the burdens incident to its use.

Co-ordination of Municipal and Private Plant Brought About in Interest of Consumers.—Nineteen persons in the city of Parowan, Utah, were denied a permit by the Public Utilities Commission of Utah for authority to take electrical energy from the Parowan city electric plant instead of from the plant of the Dixie Power Company, which is now serving the section in which the petitioners reside. The commission also ratified a contract existing between the city of Parowan and the Dixie company whereby the latter will take 200 hp. minimum from the Parowan city plant so long as the Parowan plant can supply it, at $1.25 per horsepower per month. The commission said that it was compelled to take into consideration "the effect that granting this petition would have upon the users of power and light in the remainder of the territory occupied by the Dixie Power Company. The loss of income now derived by the power company in the vicinity of Parowan, together with the capital loss entailed by the enforced removal of the existing transmission lines, would ultimately have been borne by the users in St. George, Cedar City, Hurricane, Washington, Summit and various other communities and industries now served by it." The power company will take the service from the city just outside the city power plant, will transform it from 2,300 volts to 33,000 volts and will furnish the city also with emergency or breakdown service at the same rates that the city is charging for power, except that there is to be no minimum. Under the terms of the agreement approved the municipal plant virtually becomes a part of the power company's system as to all power except that required by Parowan and Paragonah, which are the first concern of the municipal plant.

Nature of Annual Depreciation Allowance.—In calculating annual depreciation allowance for the Missouri Union Telephone Company the Public Service Commission of Missouri said that it must be borne in mind that the purpose of a depreciation reserve is to retire the investment in depreciable property at the end of its useful life. The commission continued: "The depreciation reserve is a retiral reserve and not a replacement reserve. Consequently, any estimate of the annual depreciation requirement should be based upon the investment in depreciable property. Should the cost of a new item of property exceed the cost of the item of property displaced, the excess is properly chargeable to capital account, and such excess must ultimately be provided for through the sale of stocks or bonds or both. The creation of a reserve in excess of the amount required to retire the investment in depreciable property at the end of its life results in collecting an excess sum from the consumer to finance additions and betterments in full or in part, which is unjust, inequitable and illegal. The point to be emphasized is that no matter what the present fair value of a property may be, or what its cost of reproduction may be, the actual cost of the depreciable property is the basis upon which the annual depreciation requirement should be calculated."

Recent Court Decisions

Claim on United States for War-Time Aid to Central-Station Company Disallowed.—The United Gas & Electric Engineering Corporation has lost in its effort to collect $16,095 from the Federal government, the Supreme Court having, without a written opinion, affirmed the finding of the Court of Claims that the United States is not obligated to pay any sum to the corporation. The amount was claimed as due for services, expenses and profits in connection with improvements in the power plant of the Little Rock (Ark.) Railway & Electric Company during the war to provide power for the picric-acid plant of the Everly M. Davis Chemical Corporation. The Court of Claims held that if any payment is due it should be made by the chemical company or the Little Rock electric company.

What Constitutes Contributory Negligence.—Fike vs. San Joaquin Light & Power Corporation was an action for damages because of the death of a workman who came into contact with defendant's unguarded high-voltage wires while he was working on the roof of an ice company supplied with energy by the San Joaquin corporation. Judgment for the plaintiff has been affirmed by the California District Court of Appeal and hearing denied by the Supreme Court of the state. The issues involved concerned contributory negligence and were decided adversely to the company, the court saying that it was for the jury to decide whether warning signs on posts 10 ft. from the wires were sufficient caution. It was immaterial what instructions others had received since the deceased had not received them. There was no merit in the allegation that the man was a trespasser or a mere licensee since he was carrying out the orders of his superior for his employer. (239 Pac. 344.)*

Company Responsible for Accident Caused by Its Allowing Pole to Lie in Roadway.—The Supreme Court of Virginia has affirmed an award of damages (Wilson vs. Appalachian Power Company) to a man who was driving with his family down a road on a hillside when the tongue of his vehicle dropped to the ground and struck a pole belonging to the company which had been negligently allowed to lie in the roadway awaiting use. Evidence was that the man had control of his team and would have reached the bottom of the hill without damage had the pole not been where it was. Its presence and not any antecedent negligence on the part of the driver was held to have been the proximate cause of the accident. (129 S. E. 277.)

What Is a Proper Allowance for "Going Value"?—The Supreme Court of Idaho in Consumers' Company vs. Public Utilities Commission had before it a dispute over what constitutes a proper allowance for "going-concern" value. Affirming the commission's allowance, the court said that, while the property of a well-managed, successful and profitable utility has a "going-concern" value which must be included in the total on which it is entitled to a return, going-concern value of the property of a utility is included in the total value found to exist where the commission has heard and considered evidence relating to business and property and made such additions thereto as the evidence justifies, has included such values as are proper for overheads and has valued the physical property of the utility as a successful going concern. (239 Pac. 730.)

Maintainer of Dam Cannot Throw Responsibility on Contractor for Damage from Freshets.—Affirming an award for damages from flooding due to a not unprecedented freshet occurring while a dam was being reconstructed and the old spillway out of service (Trump vs. Bluefield Waterworks & Improvement Company), the Supreme Court of Appeals of West Virginia said that one constructing and maintaining a dam across a steam must take into consideration such freshets as from climatic and geographical conditions may reasonably be expected, whether of frequent or infrequent occurrence. It decreed further that the defense that one engaging an independent contractor is not responsible for the negligence of the latter has no application where a resulting injury, instead of being collateral and flowing from a negligent act of the contractor's employee alone, is one that might have been anticipated as a direct or probable consequence of the performance of the work contracted for, if reasonable care is omitted in the course of its performance. In such case the person causing the work to be done will be liable. (129 S. E. 309.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Coolidge Reassures "True Business"

Service Function of Industry Outlined—Policy of Administration to Support Business Vigilantly—Economic Aid Abroad and World Court Approved

THE relation of business and government was outlined by President Coolidge in his address before the Chamber of Commerce in New York last week, when he made it clear that business and government should be as largely as possible independent of each other. Business and government should "each be sovereign in its own sphere," he said, and he reassured "true business" that the administration was its supporter and friend. An important function of business was defined by the President when he said, "It rests squarely on the law of service." A sound policy for government regulation was explained as well as the reasons therefor, and the President said that any interest which the government exercised was designed to promote the success of business.

After expressing his desire that business and government should develop a mutual understanding and dwelling on the advantages that would accrue to the general welfare of the country through a better knowledge by both parties of the multifold problems with which each has to deal, he said: "When government comes unduly under the influence of business, the tendency is to develop an administration which closes the door of opportunity, becomes narrow and selfish in its outlook and results in an oligarchy. When government enters the field of business with its great resources it has a tendency to extravagance and inefficiency, but having the power to crush all competitors, likewise closes the door of opportunity and results in monopoly."

Service Function of Business

In defining true business and outlining its service function, the President said: "True business represents the mutual organized effort of society to minister to the economic requirements of civilization. It is an effort by which men provide for the material needs of each other. While it is not an end in itself, it is the important means for the attainment of a supreme end. It rests squarely on the law of service. It has for its main reliance truth and faith and justice. In its larger sense it is one of the greatest contributing forces to the moral and spiritual advancement of the race.

"It is the important and righteous position that business holds in relation to life which gives warrant to the great interest which the national government constantly exercises for the promotion of its success. This is not exercised, as has been the autocratic practice abroad, by directly supporting and financing different business projects, except in case of great emergency, but we have rather held to a democratic policy of cherishing the general structure of business while holding its avenues open to the widest competition, in order that its opportunities and its benefits might be given the broadest possible participation.

True Business Has Full Support

"While it is true that the government ought not to be and is not committed to certain methods of acquisition which, while partaking of the nature of unfair practices, try to masquerade under the guise of business, the government is and ought to be thoroughly committed to every endeavor of production and distribution which is entitled to be designated as true business. Those who are so engaged, instead of regarding the government as their opponent and enemy, ought to regard it as their vigilant supporter and friend.

"It is my belief that the whole material development of our country has been enormously stimulated by reason of the general insistence on the part of the public authorities that economic effort ought not to partake of privilege and that business should be unhampered and free. This could never have been done under a system of freight-rate discriminations or monopolistic trade associations. These might have enriched a few for a limited period, but they never would have enriched the country, while on the firmer foundation of justice we have achieved even more ample individual fortunes and a perfectly unprecedented era of general prosperity."

President Coolidge also referred to the conservation of use of materials and conservation of energy in which the country has been engaged during the past five years. He said: "It is in no small part responsible for the rich reward in the increasing comfort and living standards of the people. But in addition to bringing about a condition in which the government debt is being rapidly liquidated while at the same time taxes are greatly reduced capital has become abundant and prosperity reigns."

Regarding foreign loans the President said: "If rightly directed, they ought to be of benefit to both lender and borrower. If used to establish industry and support commerce abroad, through adding to the wealth and productive capacity of those countries, they create their own security and increase consuming power to the probable advantage of our trade. But when used in ways that are not productive, like the maintenance of great military establishments or to meet municipal expenditures which should either be eliminated by government economy or supplied by taxation, they do not appear to serve a useful purpose and ought to be discouraged."

After talking about the work of restoring the fiscal condition of Europe, which was accomplished with American assistance, the President said: "These efforts and accomplishments, whether or not they be appreciated at home or received with gratitude abroad, which have been brought about by the business interests of our country, constitute an enormous world service. Others have made plans and adopted agreements for future action which hold a rank of great importance. But when we come to the consideration of what has been done, when we turn aside from what has been promised to examine what has been performed, no positive and constructive accomplishment of the past five years compares with the support which America has contributed to the financial stability of the world. It clearly marks a new epoch."

World Court Approved

The President also said that there are constantly accumulating reasons why we should signify our adherence to the Permanent Court of International Justice. "In our domestic affairs," he said, "we have followed the declaration that we believe in justice by establishing tribunals that would insure the administration of justice. What we have been able to do in this respect in relation to the different states of our Union, we ought to encourage and support in its proper application in relation to the different nations of the world. I can think of no more reassuring action than the declaration of America that it will whole-heartedly join with others in the support of the tribunal for the administration of international justice which they have created. I can conceive of nothing that we could do which involves assuming so few obligations on our part that would be likely to prove of so much value to the world."

Swope Expects Better Business in 1926

GERARD SWOPE, president of the General Electric Company, in a recent talk before the employees of the Lynn (Mass.) works of the company, referred to the increasing business of the company and said that his company is looking forward to an increase in business in 1926 as compared with 1925. Extracts from his talk are as follows:

"As we see business conditions, they are fair. You have seen our report for the third quarter—that we did $73,000,000 worth of business, or 26 per cent greater than for the same

quarter of last year. For the nine months it was $223,000,000, which is about 10 per cent higher than last year. We are looking forward to 1926 for a fairly good year, with some increase over this year's business. I want to correct the impression, which is a general one, of how easy it is for the General Electric Company to secure business. The company does a large business, but for every dollar's worth of business we received last year three dollars went to others.

"Reductions in costs work all along the line toward a larger volume of business. We experienced this last year in the direct-current and induction-motor line. We increased the volume of work and in April of this year were able to reduce the selling prices. The motor business has increased since that time. We won't reduce prices if conditions won't allow. We are not trying to drive anybody out of business. If our competitors reduce prices, even if our margin will not allow we must follow suit. When we reduce prices voluntarily it means we have improved our methods so we can still make a fair margin of profit."

Conservation of Pole Timber

Broad Economic Policy Which Would Provide a Logical Area of Distribution for Each Zone—Policy of Scientific Buying Would Have Far-Reaching Effect

By W. F. Bancker

President American Forest Products Company,
Formerly General Purchasing Agent of Western Electric Company

THERE is a single broad economic policy which will conserve the forests, make poles give the most service for the smallest cost, and as a result better meet the requirements of the public. Its successful working out lies in the hands of those who produce and consume pole timber, and of course very largely in the hands of the public utilities. The development of this striking program is new; it is, perhaps, the last basic measure of conservation to be adopted. Yet it is in many ways the simplest and most natural measure of all, and certainly it is the most immediate in its practical benefits alike to conservation, business and the whole public.

The new policy or method rests upon the natural distribution of pole timber over the United States. Natural growth has divided the country into rather definite areas or zones, as shown on the accompanying chart. The most important regions are the white-cedar zone in northern New England and Canada; the chestnut zone of the Appalachian Mountains; the Southern yellow pine zone of the Gulf States; the Northern white cedar of the Great Lakes, and the red-cedar area of the Northwest.

Logical Distribution Areas

Obviously each of these zones has a logical area of distribution. If the pole supply of the country were being used in the most economical way, one would expect to find the poles of each zone being set in the general territory where they grow. Such practice would mean the lowest possible cost for transportation and would make possible other economies. But frequently poles are shipped far out of their natural zones at increased cost to the user. Moreover, there is continual sales effort to extend distribution outside of the logical, economical area of consumption still further. This effort is destructive, because it hastens unduly the destruction of forests, and it introduces unnecessary factors of cost. Oddly enough, as our forests disappear there arises greater capacity for cutting down trees than ever before. In about seventy years approximately two-thirds of our original forest has been used up; yet here we are with constantly increased productive capacity, stimulated all the time by sales efforts which try to force timber from one zone farther and farther into another zone.

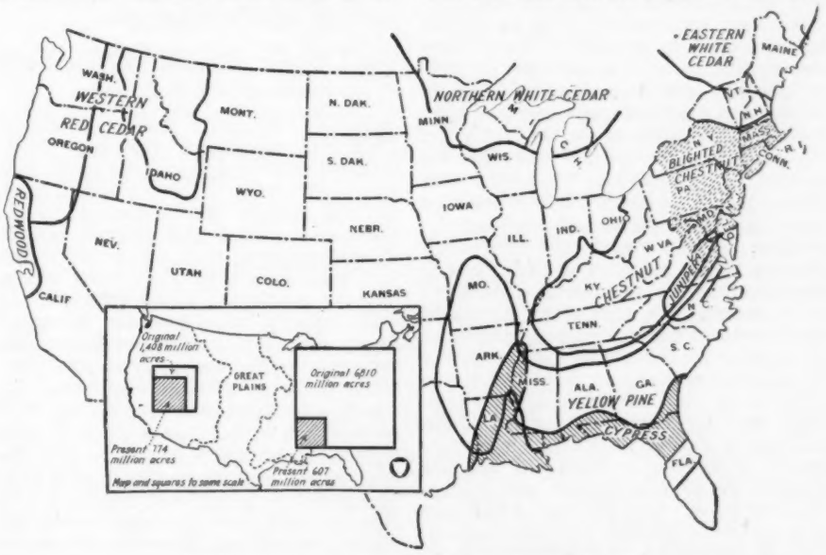
Policy of Scientific Buying

The adoption of a policy of scientific buying cannot fail to have far-reaching effect. For one can more or less accurately follow nature's own lines and purchase for use in each general region of the country timber produced in or near that region. The economy in transportation is quite evident, but the recognition of the zone system by consumers of poles will be accompanied by a number of other important economies as well as by great aid to the cause of conservation. In the first place, quantity production is needed in order to make possible some fundamental savings. It is plain that there can be no massed production over the country as a whole; the zone system in its very nature involves a decentralization to conform to areas of natural growth. But within each one of these areas quantity production is the means of great economy and efficiency.

Most significant in respect to quantity production within each zone of growth is the butt-treating of the poles. Preservative treatment prolongs the life of the poles—perhaps even doubles the life under some circumstances—and a proper organization of each zone makes possible such treatment on the most effective possible basis. For example, there are a number of plants for the butt-treating of poles in the chestnut stands of the Appalachians. Chestnut poles can be brought out, inspected, sorted, classified and butt-treated at these plants and sent on their way into distribution at minimum cost, and the very considerable saving is directly available to all classes of public utilities in or near this zone; that is, all through the eastern part of the country.

This particular zone is of greater importance because of the chestnut blight which threatens to destroy the remaining stands of this useful tree. Passed into consumption at an even rate, chestnut poles will meet the demand of this section of the country for a considerable period, thus preventing the waste due to blight and adding one more item of economy. And if they are butt-treated before being set in the line their increased life will be reflected in lower annual charges and reduced-maintenance and replacement costs over a period of years.

Other savings which have been made possible by the zone system are easily understood. They are: Reduced cost of cutting and handling, better utilization of byproducts and elimination of waste through better regulation of production within the zones. The factor of control will generally be the price at



Distribution of Pole Timber in United States

Insert compares original and present virgin forest areas of the Eastern and Western forest regions. Note that only a remnant of the original Eastern forest remains and that nearly half of the virgin forests of the West have gone.

the consuming point, and one zone will invade another only so long and so far as it is economical and advantageous for this to happen.

Responsibility for this important program must rest upon the producers and consumers of pole timber. The advantage to public utilities lies not only in the considerable saving of money, protection of future pole supply and economy of maintenance due to longer life of treated poles, but also in the public good will which this plan cannot fail to earn.

Business Conditions

ORDERS for more than one million dollars' worth of generating equipment were placed this week in an electrical market that continues active. Other large orders pending, and which are expected to be placed in a few days, will call for transformers and such auxiliary apparatus and will amount to nearly $1,000,000. Industrial plants are active in many parts of the country, and plans include buying a fair amount of apparatus.

An especially good demand for electric ranges is noted, particularly in the Southeast. One manufacturer reports that his entire production has been sold, and others all report a good increase in sales as compared with last year to date. The industrial lighting campaign that is being undertaken in many cities is meeting with remarkable success. A prominent manufacturer, in pointing to increasing sales in 1925, reports that business next year is expected to exceed what will be transacted this year. Steel is on the upward trend, with better buying, but consumption apparently has not increased.

In New England trade is in steady volume, electric industrial truck sales are increasing with a growing number of inquiries, and the volume of business in electric ranges is in excess of that for the corresponding period last year. An order for three waterwheels, amounting to about $145,000, was placed in that district. Many inquiries covering transformers and auxiliary apparatus are reported in the New York district and are expected to be placed shortly, and the market is considered quite active. An order was placed in that territory for generating equipment amounting to about $700,000, and sales of railway equipment are said to be good. In the Southeast industrial firms are showing more activity, and confidence in the future is more generally expressed. Sales of electric ranges in that territory are exceptionally good. The volume of business is good in the Middle West and central-station companies and industrial firms are buying actively. On the Pacific Coast power company buying is marked by many orders for construction tools, and industrial purchasing is considered normal with indications of an improvement.

Zinc Strong—Other Non-Ferrous Metals Decline

FURTHER concessions have been made by copper producers owing principally to the decline in the London market. Several sales were made at 14⅜ cents, and some producers have been accepting business at that figure for delivery in the first quarter of next year. On Wednesday several buyers withdrew from the market rather than pay 14½ cents to some producers. Consumption continues good.

NEW YORK METAL MARKET PRICES

	Nov. 18, 1925 Cents per Pound	Nov. 25, 1925 Cents per Pound
Copper, electrolytic	14⅜	14½
Lead, Am. S. & R. price	9¼	9¼
Antimony	20	20
Nickel, ingot	34	34
Zinc, spot	8½	9
Tin, Straits	63¾	62¾
Aluminum, 99 per cent	29	29

Base copper price Nov. 25, 1925, 16½ cents

The American Smelting & Refining Company maintains its official contract price for lead at 9¼ cents. The market is quiet, but demand is steady. Zinc was very active on Wednesday—the only metal with an upward price trend. There is a good demand for prompt as well as December shipments. The market for tin has declined, being not well supported in London, and consumers are taking advantage of the weakness to purchase their requirements.

Good Orders Placed in New York District—Market Active

MANY inquiries from central-station companies covering transformers and other auxiliary equipment are reported in the New York district. Several orders are expected to be placed soon, and the market is considered quite active. One order has just been placed for generating equipment amounting to about $700,000, and some equally large business for other types of equipment is pending. Distribution equipment and supplies continue to be in steadily increasing demand and show a sales volume well above that of last year at this date. Industrial plants are active and are placing orders for motors and control equipment in small but frequent lots. The demand for wire and cable has abated somewhat, but manufacturers are busy filling previous orders and, basing their feeling on present inquiries, are quite confident of receiving some good orders in the near future.

Pole-line hardware is in fair demand, with the majority of the orders being placed by syndicate companies for new construction work. A large order has just been placed for material to be used on some Southern properties. Little material is being purchased for maintenance work. There are not many inquiries on hand, but plenty of work is known to be contemplated for next year. Jobbers continue active and report a steady demand for diversified lines with good sales of appliances.

Industrial Firms More Active in Southeast—Ranges in Demand

CONFIDENCE in the future is expressed generally in the Southeast, and construction work discussed early in the year and later abandoned is again being taken up for final disposition. This is particularly true of a number of industrial firms whose managements give indication of completing expansion programs planned the first of this year. Textile plants are again showing activity, and prospects are for the electrification of a number of large mills in the next few months. The Tennessee Electric Power Company has just announced that during 1926 approximately $7,000,000 will be spent on improvements and expansions to its system, the largest single item to be the construction of a dam on the upper Ocoee River near Blue Ridge, Ga., at a cost of $1,600,000.

An increasing popularity is noted in the demand for ranges, and one manufacturer states that sales of ranges, socket appliances and hotel-kitchen equipment to date this year shows an increase of 89 per cent over 1924. Central-station companies are using the idea of an electric range as a Christmas gift with considerable success. Optimism on the part of the trade is evidenced by its willingness to place orders in anticipation of increased business, and manufacturers report some satisfactory 1926 contracts already in hand with others in prospect. There is some trouble with slow deliveries on ranges, but as yet dealers are not handicapped by this condition. Jobbers report satisfactory business in practically all lines, though wiring device sales in the Atlanta territory are not up to expectations. Small motors ranging from 5 hp. to 200 hp. continue to show improvement, and while there are no large single orders reported, the volume is satisfactory. Farm-lighting equipment, which has been dormant for some time, is showing an improvement in south Georgia, Alabama, Mississippi and Louisiana, but little activity is to be noted in north Georgia and South Carolina.

Large Order for Equipment Placed on Pacific Coast

BUYING by central-station companies on the Pacific Coast is marked by orders for construction tools, pole-line hardware and poles, one order for the latter covering 400 poles in 35-ft. to 50-ft. lengths. Maximum pole-line hardware quantities have been reduced to about one-tenth of the old requirements with prices in about the same ratio. In the northwestern section of the Pacific Coast the only purchasing has been by the city of Tacoma for the Lake Cushman hydro-electric project. Lumber companies and industrial plants are buying at about a normal rate, with indications of a moderate improvement after the first of next year.

Railroad buying is very good, varying from dispatching equipment to standard wiring devices, but marked by no outstanding orders. A nine-million-dollar office building is announced for early construction in San Francisco.

The city of Los Angeles has recently called for bids on about $20,000 worth of galvanized conduit.

Volume of Business Good in Middle West—Industry Active

INDUSTRIAL activity in the Middle West is increasing and the various utility companies are buying quite heavily. Distribution equipment is much in demand, principally transformers, meters, circuit breakers, etc. Several interesting orders were placed for such equipment. Maintenance purchases have been large and help materially to increase the general volume of business. A prominent central-station company is planning the installation of two automatic substations of several thousand kva. each.

Jobbers report that all appliances are moving well. One distributor reports placing orders for 1,000 vacuum cleaners, 300 washing machines and 500 percolators. Electric ranges have been selling well, and one factory has stated that its entire production has been sold. The industrial lighting campaign started in Kansas City this week and is meeting with enthusiastic support. An organization for servicing electric appliances is being inaugurated in the Middle West to handle servicing for a large number of dealers.

Trade in New England Steady—Industrial Trucks Active

NEW ENGLAND trade is steady, with jobbers directing their attention to seasonal equipment and supplies and manufacturers reporting a satisfactory movement. Electric industrial trucks are attracting interest, and one manufacturer reports several recent sales and an increasing number of inquiries. Electric ranges are moving fairly well, one manufacturer recording a steady demand and the volume of business to date this year much in excess over that for a corresponding period last year. Small motors are maintaining about the same level in sales. Fractional-horsepower capacities are in good demand, and one manufacturer reports difficulty in delivering the more common sizes. Another company records a good demand which has required full force and full-time plant operation, with business to date in encouraging excess over that of last year.

Sales of wiring devices are very good, but, on the other hand, the demand for wire, armored cable, conduit and line hardware has fallen off. New building construction for this month shows a decided decline in this district. The Central Maine Power Company recently purchased three 9,000-hp. waterwheels at a cost of about $145,000, and electrical equipment for this new development will be purchased soon. The Brockton Edison Company has arranged to supply the Ames Tool & Shovel Company with electric power which will be utilized in a motorization plan requiring 500 hp. The proposed New England Power Company transmission line which will be built between Millbury, Mass., and Medway, was reported on these pages last week as costing $29,300. The report should have read $29,300 per mile.

Activities of the Trade

Thoner & Martens Report Rapid Increase in Business

Owing to the extension of interconnection programs and the expansion of power networks, the demand for high-voltage switches as reported by Thoner & Martins, Boston, is rapidly increasing. The company's factory is at present handling a remarkably steady output, running well above that of last year, including a recent noteworthy order from an American copper company in the Chilean Andes for transmission service. The company reports a growing demand for custom-made switches, involving care in quality of material and in sizing of parts. This company also reports active business in the low-voltage, heavy-current field, a large order having been received lately from the New York Edison Company.

Brown, Boveri Company Purchases Moloney Electric

The American Brown, Boveri Electric Corporation has announced the acquisition of the Moloney Electric Company of St. Louis. Brown, Boveri now has added to its organization a plant completely equipped to manufacture transformers. The Moloney company will retain its own sales staff. Laurence R. Wilder, president of the American Brown, Boveri company, states that Moloney does an annual business of $2,250,000. The company has also announced the election of William V. Griffin, of the Anthony N. Brady estate, and Fred Allison, an engineer of the Ford Motor Company, to the board of directors.

McGraw-Hill Company Purchases EMF Electrical Year Book

The McGraw-Hill Company has announced the purchase of the "EMF Electrical Year Book," published by the Electrical Trade Publishing Company, Monadnock Block, Chicago. The 1926 edition, which will be available on April 1, 1926, will be edited by the staff of the Electrical Trade Publishing Company and sold by the staffs of both organizations. Headquarters for the year book, until completion of the 1926 edition, will be at the offices of the Electrical Trade Publishing Company in Chicago, but information and data may be secured from men of both organizations. This standard reference book will supplement the service of the McGraw-Hill electrical publication by supplying the reference information needed by the men of the industry.

Westinghouse Gets Order for Large Frequency-Changer Set

The Commonwealth Edison Company of Chicago recently contracted for a 40,000-kva. frequency changer set for installation in an addition to its Fisk Street generating station to care for its growing need for 25-cycle power. The equipment was ordered from the Westinghouse Electric & Manufacturing Company. The set will consist of a 100 per cent power-factor, 40,000-kva., 9,000-volt, three-phase, 25-cycle generator, mounted on the same bedplate with and rigidly coupled to an 85 per cent power-factor, 54,500-hp., three-phase, 60-cycle driving motor, operating on 12,000 volts. On the same bedplate will also be a starting motor and two direct-connected exciters, one at each end of the set, supplying excitation current to the motor and generator separately. The set will be arranged for a closed-circuit cooling system.

The Allis-Chalmers Manufacturing Company, Milwaukee, has opened a new district office in Lima, Peru, in charge of W. G. Bolton. This office, as well as the one at Oruro, Bolivia, is a branch of the company's office at Santiago, Chile, of which W. R. Judson is manager. The Oruro office is in charge of P. G. Gilliard, succeeding Erling Winsnes, who has returned to the United States.

The Jeffery-Dewitt Insulator Company, Kenova, W. Va., announces that it has received an order for several thousand insulator units from the Public Works Department of New Zealand for use on the Waikato development. These insulators will be used on a 110-kv., double-circuit, 105-mile line erected on steel towers. There will be 3,600 suspension insulators of five "J-D" units each and 300 strain strings of six "J-D" units each, which will be delivered at Wellington. A small order has also been received for units to be delivered at Auckland.

The Automatic Electric Washer Company, Newton, Iowa, announces that it has placed its new model No. 264 copper-tub electric washer on the market. This model is said to embody all the features of its No. 214-C model as well as a number of new refinements.

The Wisconsin Electrical Manufacturing Company, 453 East Water Street, Milwaukee, manufacturer of switchboards and panel boards, has awarded contracts for a one-story-and-basement factory building, at 1101 Clybourn Street, to cost $40,000.

The Connecticut Telephone & Electric Company, Meriden, Conn., announces that its New York representatives, James J. Sheeran, who handles its line of telephones and signaling apparatus, and V. F. Harkness, who handles the sale of "Cetec" (cold-molded insulation), are now established at 51 Chambers Street, room 616, New York City, where an exhibition of equipment is installed.

The Benjamin Electric Manufacturing Company, Chicago, announces the following changes in its sales organization: Raymond Ackerman will represent the company in Utah, Idaho and eastern Nevada with headquarters at 216 Southwest Temple Street, Salt Lake

City; Merritt L. Tice, who had headquarters in Baltimore, has transferred his main activities to Birmingham, Ala., J. B. Wright, his assistant, remaining at Baltimore; L. W. Lawrence will succeed W. G. Church in the New England States and can be reached by addressing P. O. Box 114, Braintree, Mass.; Oliver C. Westberg will handle the general line and F. C. Unger will specialize on panelboards in the Chicago territory, and H. H. Hauge is now in new offices at 607 Third Avenue, Wauwatosa, Wis.

The Allis-Chalmers Manufacturing Company, Milwaukee, announces that it has opened an office in Houston, Tex., temporarily at 231 Rodgers Building, in charge of R. I. Moore, formerly in the Dallas office. After January 1 next the office will be at 1108 Post-Despatch Building. This office will be operated as a branch of the Dallas office. E. W. Burbank is district manager at Dallas.

The Condit Electrical Manufacturing Corporation, South Boston, Mass., manufacturer of circuit breakers and power switchboards, announces that its New York representative, the F. W. Nason Company, has appointed Allen Ashley and G. E. Schultz as special representatives, with headquarters at 105 West Fortieth Street.

The Delta-Star Electric Company, 2400 Block, Fulton Street, Chicago, has been awarded the contract for the outdoor substation equipment for the Harvey and Vollmer Road substation of the Illinois Central Railway electrification, for supplying service to the electrification project now under way.

The Bell Telephone Laboratories, Inc., 463 West Street, New York, has completed plans for alterations and improvements in its thirteen-story plant at West and Bethune Streets, to cost about $25,000. Work will begin at an early date.

The Servel Corporation has recently appointed L. W. Driscoll as Southeastern district manager, with offices in the Bona Allen Building, Atlanta.

The Moe-Bridges Company, 236 Broadway, Milwaukee, manufacturer of electric fixtures, lamps, etc., will begin the construction of a new three-story factory branch and distributing works at Orlando, Fla. to cost in excess of $50,000, with equipment.

The Westinghouse Lamp Company has recently completed a one-reel motion picture film, known as "The Light Brigade," which is being shown at meetings of wholesale and retail electrical dealers and central-station companies all over the country. The purpose of the film is to show the dealer how advertising and merchandising lamps will increase sales.

The Union Electrical Supply Company, Providence, R. I., has opened a branch jobbing house at 20 Commercial Street, New Bedford, Mass. A complete stock of electrical and radio merchandise will be carried, and the branch will be in charge of Samuel A. Jenks.

The Utilities Coal & Supply Company, 33 Grand Streets, New York, announces that owing to the growth of its business along electrical lines it has changed its name and will hereafter continue its business under the name of the Utilities Electric & Supply Company.

The Foxboro Company, Inc., Foxboro, Mass., manufacturer of indicating, recording and controlling instruments, announces the transfer of its Southern office to room 426, Atlanta Trust Building, Atlanta. This office, which was previously situated in Birmingham, will be in charge of A. W. Taber, who has for several years been connected with the company as a sales engineer.

The Kuhlman Electric Company, Bay City, Mich., manufacturer of transformers, has awarded a contract for an addition to its factory, 75 ft. x 250 ft. In this new building the company is preparing to build the larger sizes of transformers.

The Delco-Light Company, Dayton, Ohio, manufacturer of the "Frigidaire" electric refrigerator and other Delco-Light products, announces the establishment of a public utilities division at 285 Madison Avenue, New York City. This New York office is in charge of William R. Winans, formerly in the merchandising department of the Henry L. Doherty Company, and a corps of men trained in public utilities service will be associated with Mr. Winans in the work at the New York office. The establishment of this New York office under Mr. Winans is to permit a readier and more advantageous contact with the many large power companies whose headquarters are in the East.

The Standard Electric Stove Company, 1714 North Twelfth Street, Toledo, Ohio, announces that Charles R. Strother, formerly salesman for the Post-Glover Electric Company in West Virginia territory, is now representing the company in West Virgina, North Carolina, Tennessee and eastern Kentucky.

The Westinghouse Electric & Manufacturing Company announces that it has now added an elliptical angle reflector, in which the bowl of the reflector is flattened into the form of an ellipse, to its line of porcelain enameled reflectors.

The Westinghouse Lamp Company will build a research laboratory on the site of its existing plant at Bloomfield, N. J. The building will be L-shaped, of reinforced concrete, 113 ft. x 93 ft., and so planned that three additional floors may be added without changing the foundations. The contract has been awarded to Stone & Webster, Inc., 147 Milk Street, Boston.

The Pittsburgh Transformer Company, Pittsburgh, announces the appointment of M. W. Phelps as district manager of the Buffalo and Niagara Falls district, with headquarters at 601 Electric Building, Buffalo. N. H. Spencer, who has been in charge of the Buffalo office for many years, has been promoted to sales engineering in the home office at Pittsburgh.

New Equipment Available

Automatic Emergency Light Unit

A turbo-generator set in sizes from ½ kw. to 10 kw. is being manufactured by the Standard Turbine Corporation, Scio, N. Y., arranged for use as an emergency light unit for the power station, the set starting automatically when for some reason the regular light supply in the station momentarily fails. The automatic starting is accomplished by an electric relay operating a shut-off valve in the turbine steam line.

The construction of the turbo-generator is similar to the regular turbo-generator built by the company for oil-field light sets and generators used for boats, magnet cranes, barges, etc. It is characterized principally by its large stable governor, around which the whole set is designed. This governor operates in the oil space of the bearing pedestal and is thus assured of constant lubrication, rendering governing steady and reliable. The blading and nozzles of the turbine are non-corrosive and non-erosive, and the generator is made an integral part of the turbine.

Housing Framework for Oil Circuit Breakers

A new housing framework for type FK-54 oil circuit breakers is now being manufactured by the General Electric Company and is designed primarily to meet the demand for equipment which can be installed with a minimum of skilled work. The three runways of the framework are welded in one solid piece, forming a base plate to which is welded an overhead structure of angles and steel straps. While the design is simplified, there is said to be sufficient strength to hold bushings, contacts and runways in permanent alignment. To install it is only necessary to run the housing into the cell, secure it with grouting through the base plate and make the usual connections.

Units are securely interlocked against any attempted withdrawal of closed breakers, and there is a positive interlock between tripping coils so that the opening of one unit opens the entire circuit. A grounding device on each breaker, consisting of a long blade on the housing which engages a spring clip on the unit, gives grounding protection until the main contacts have been separated three inches.

Bus Support.—A support for potential and synchronizing buses for 600 volts or less, made of non-fragile material and designed to withstand tight clamping, has been developed by the General Electric Company. This support will hold three ¼-in. bus tubes and, with the addition to spacers, will hold three additional tubes. It is furnished with insulating tubes for holding copper tubing but is also adaptable to the use of copper tubing insulated with circular loom. It is also planned to furnish main fittings, where necessary, for either pipe or angle iron.

New Trade Literature

FLEXIBLE BELT DRIVE.—The Allis-Chalmers Manufacturing Company, Milwaukee, has issued bulletin No. 1,228 covering the Allis "Texrope" drive, a flexible and positive multiple-belt drive for close centers, which is especially adapted for use in textile industries. It contains illustrations showing various applications of the "Texrope" and a diagram for determining sheave diameter or distances between centers. Tables of pitch, circumferences of stock belts and horsepower ratings for "Texrope" drives are included.

TRANSMISSION-LINE EQUIPMENT.—The Bates Expanded Steel Truss Company, East Chicago, Ind., is distributing a booklet calling attention to the Bates expanded steel poles, fabricated towers and substations. Illustrations are given showing various types of Bates poles, towers and substations, and the booklet contains a list of the Bates installations made in forty of the forty-eight states of the United States and in thirty-one foreign countries.

HANDLING OF MATERIALS.—"Materials Handling" is the title of circular No. 7,378 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describing its electrically driven equipment manufactured for handling materials, including cranes, hoists, winches, conveyors, coal-loading machinery, freight elevators, trucks, locomotives, dredges, etc.

BALL BEARINGS.—The New Departure Manufacturing Company, Bristol, Conn., is distributing a folder calling attention to the use of "New Departure" ball bearings in electric motors.

AUTOMATIC SWITCHING EQUIPMENT.—A leaflet (GEA-41) distributed by the General Electric Company, Schenectady, N. Y., covers its type "MC-10" motor-operated timing relay for 110-volt and 220-volt circuits of any frequency.

PLUG CAPS AND FLUSH RECEPTACLE.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing two leaflets, Nos. 44a and 60a, describing the Hubbell interchangeable "Cord-Grip" plug caps and the Hubbell 30-amp. polarized flush receptacle respectively.

PUMPING EQUIPMENT.—The De Laval Steam Turbine Company, Trenton, N. J., is distributing a leaflet entitled "De Laval Pumps at Tulsa, Okla.," which describes the De Laval steam-turbine-driven centrifugal pumping units used in the water-supply system of Tulsa, Okla.

STREET-LIGHTING GLASSWARE.—Bulletin GEA-103, issued by the General Electric Company, Schenectady, N. Y., entitled "Street-Lighting Glassware," contains a historical introduction, a detailed description and numerous illustrations showing the steps in the manufacture of the units, a discussion about refractors, and dimensional diagrams of the different types of outer globes, canopies and panels.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Oslo, Norway (No. 17,871), for electrical appliances, radio sets and parts. Purchase is also desired (No. 17,878) of large and small size electric refrigerators.

Purchase is desired in Shanghai, China (No. 17,929), of electrical goods.

An agency is desired in London, England (No. 17,877), for electrical specialties and insulating tape; also for small or individual electric refrigerating plants (No. 17,879).

An agency is desired in Caracas, Venezuela (No. 17,879), for electrical supplies and appliances.

An agency is desired in Vienna, Austria (No. 17,890), for electrotechnical articles and lighting supplies; also for insulating materials (No. 17,841).

Sole agency is desired in Cape Town, South Africa (No. 17,880), for electrical hot-water heaters of instantaneous and immersion types.

Purchase and agency is desired in Plymouth, England (No. 17,838), for electric household appliances and lighting plants. Purchase is also desired of radio accessories and parts (No. 17,837) and of radio sets and parts (No. 17,838).

Purchase and agency is desired in Dairen, Manchuria (No. 17,884), for radio parts.

Purchase and agency is desired in Amsterdam, Netherlands (No. 17,839), for radio sets and accessories; also for radio sets and parts (No. 17,842).

Construction News

Projects, Plans, Bids and Contracts,
Contemplated or Under Way

New England States

FALL RIVER, MASS. — The Firestone Cotton Mills, Inc., plans to install electric power equipment in connection with proposed extensions, to cost about $250,000.

GLOUCESTER, MASS.—Work has been started by the Gloucester Electric Company on extensions to its electric plant, to cost about $150,000. Contract for the building has been awarded.

HUDSON, MASS.—The Firestone-Apsley Rubber Company plans to install electric power equipment at its proposed addition, to cost about $500,000.

LAWRENCE, MASS.—From an item published in these columns in the issue of Nov. 14, it might be erroneously inferred that the Eastern Massachusetts Street Railway Company is to provide ornamental lighting on Essex Street. The Lawrence Gas & Electric Company has the contract for this work, and the traction company has nothing to do with lighting the streets of the city.

DERBY, CONN.—The Derby Gas & Electric Company plans to build a repair and service building and warehouse, to cost about $60,000. R. W. Foote, New Haven, is architect.

Middle Atlantic States

BROOKLYN, N. Y. — The Delaware, Lackawanna & Western Railroad Company, 80 West Street, New York City, has applied to the Public Service Commission for approval of a plant for the electrification of its Twenty-fifth Street and Wallabout freight terminals in Brooklyn. It is proposed to operate electric locomotives to replace steam locomotives.

BUFFALO, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Dec. 9 for electric generators for the Buffalo State Hospital, Buffalo.

CLARKSVILLE, N. Y.—Permission has been granted the Bolivar Richburg Electric Corporation to extend its distribution lines to Clarksville and to exercise a franchise granted by the Town Board.

DANNEMORA, N. Y. — Bids will be received by James L. Long, Superintendent of State Prisons, Capitol, Albany, until Dec. 8 for refrigeration work, including refrigerating plant and cold-storage rooms at the Dannemora (N. Y.) State Hospital.

NEW YORK, N. Y.—Bids will be received by T. J. Drennan, fire commissioner, Municipal Building, until Nov. 24, for a portion of the fire-alarm system in the borough of the Bronx.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company has applied for authority to extend its lines and serve the towns of Ancram and Gallatin with electricity.

ROCHESTER, N. Y. — Plans are under way by the Rochester Telephone Company for placing its long-distance telephone wires to the east and south of the city in underground conduits, at a cost of about $70,000.

ATLANTIC HIGHLANDS, N. J. — Bids will be received by the Mayor and Council of the Borough of Atlantic City until Dec. 22 for the sale of electric lines, poles, equipment, etc., together with the building known as the old power house. For details see Searchlight Section.

ELIZABETH, N. J.—Plans for the proposed woodworking plant to be built by the Elizabeth Supply Company, include a power plant.

ELIZABETH, N. J.—The Public Service Production Company, Newark, has contracted with the American Copper Products Company, Bay Way, for the installation of a substation at its plant.

HIGHTSTOWN, N. J.—The Eastern New Jersey Power Company, Allenhurst, has secured a street-lighting contract here and plans extensions and improvements in the present system.

WOODSTOWN, N. J. — The Electric Company of New Jersey, Bridgeton, contemplates the erection of a transmission line in this section to supply electricity to a number of towns in Salem and Gloucester Counties.

PHILADELPHIA, PA. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 1, for 300 storage batteries, for the local navy yard (Schedule 4672).

PHILADELPHIA, PA. — The National Milling & Chemical Company, Harpers Mills, Philadelphia, plans to install electric power equipment in connection with the rebuilding of its plant recently damaged by fire with loss of about $200,000.

WARREN, PA.—Plans for the proposed furniture-manufacturing plant to be erected by H. V. Hazletine and Charles Foragren include a power plant.

BALTIMORE, MD. — The Maryland Creamery Company, 1726 East Pratt Street, plans to install electric power equipment in its proposed ice cream factory, on Register Street, to cost about $200,000.

BRISTOL, VA.—Extensions and improvements are contemplated by the Bristol Gas & Electric Company, a subsidiary of the Cities Service Company, New York City, involving an expenditure of about $500,000. It is proposed to increase the output of the plant by 1,700 hp.

WASHINGTON, D. C. — The Potomac Electric Power Company contemplates the erection of a 13,200-volt transmission line to a number of communities in Prince George and Montgomery Counties.

North Central States

FLINT, MICH.—The Buick Motor Company plans to install electric power equipment in connection with proposed extensions and improvements in its plant, to cost about $2,000,000.

CAREY, OHIO.—Bonds to the amount of $55,000 have been authorized for extensions and improvements in the municipal electric light and waterworks systems.

CINCINNATI, OHIO. — The American Laundry Machinery Company, Norwood, plans to install electric power equipment in its proposed plant addition at Section Street and Tennessee Avenue, to cost about $350,000.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Dec. 4, for a synchronized traffic signal system for the Division of Traffic.

CLEVELAND, OHIO. — Separate bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, until Dec. 4, for distributing transformers, and for series multiple transformers for the Division of Light and Power.

IRONTON, OHIO.—The Alpha Portland Cement Company, Easton, Pa., contemplates an addition to its power plant in connection with proposed extensions at its local mill, to cost about $800,000.

JACKSON, OHIO.—A franchise has been granted to the Hocking Power Company, Nelsonville, which plans extensions in its transmission system for local service.

TROY, OHIO.—Extensions and improvements in the municipal electric power station, to cost about $155,000 are contemplated. It is planned to consolidate the electric and waterworks plants.

BLOOMINGTON, IND. — Bids will be received until Dec. 9 for the construction of a filtration plant and pumping station, to cost about $100,000. Pearse, Greeley & Hansen, 6 North Michigan Avenue, Chicago, are engineers.

MICHIGAN CITY, IND.—Plans are being prepared by the Calumet Gas & Electric Company, Gary, for the construction of a new electric generating station at Michigan City with an initial capacity of 60,000 kw. (two units of 30,000 kw. each), to cost about $6,500,000. Power generated at the station will be transmitted on the 132,000-volt circuit for distribution over the systems of the Calumet Gas & Electric Company and the Northern Indiana Gas & Electric Company, both subsidiaries of the Midland Utilities Company, Chicago. Contract for generators has been awarded.

Sargent & Lundy, 72 West Adams Street, Chicago, are engineers.

CHICAGO, ILL.—Plans has been filed by the Acme Steel Company for a substation at its plant at 101-9 East 134th Street.

CHICAGO, ILL.—Contracts, it is reported, will soon be awarded for the installation of a new street-lighting system on State Street, from Lake Street to Van Buren Street. The present plans provide for the erection of about 140 lamp standards mounted with lamps of 4,000 cp.

CHICAGO, ILL.—Plans for the proposed local factory of the Campbell Soup Company, Camden, N. J., on West Thirty-fifth Street, to cost about $750,000, include a power plant.

QUINCY, ILL.—Petitions have been filed with the City Council by the local business men for further extensions to the ornamental lighting system to cover the entire downtown district.

SPRINGFIELD, ILL.—Bids will be received at the office of the Mayor for equipment for the municipal electric plant as follows: Section 1—for one surface type condenser with auxiliaries to condense steam for a 7,500-kw. General Electric turbine; Section 2—air conditioning equipment, including air filters for 7,500, 4,000, 3,000 and 1,500-kw. generators; Section 3—two water-tube boilers with chain-grate stokers, forced draft apparatus, etc. The cost is estimated at $85,000. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

LYNDON, WIS.—Plans are under way by the Southern Wisconsin Power Company for the erection of a 13,000-volt transmission line from its plant to Lyndon, a distance of 10 miles.

MENASHA, WIS.—Bids will soon be called for furnishing and installing an ornamental lighting system in a lighting district recently established by the City Council. J. H. Kuester is superintendent of the water and light department.

OSHKOSH, WIS.—Bids will soon be asked by the Park Board for 15,000 ft. of cable, forty aluminum holders, forty 250-cp. lamps, etc., for the street lighting system in South Park. G. Randall is city engineer.

REEDSBURG, WIS.—Plans are under way by the Southern Wisconsin Power Company, Madison, for the erection of a 33,000-volt transmission line from Kilbourne to Reedsburg. The construction of a 13,000-volt line to connect with Lyndon is also contemplated by the company.

SHEBOYGAN, WIS.—Extensive improvements are contemplated by the Wisconsin Power & Light Company, including the rebuilding of the local distributing system.

SPRING VALLEY, WIS.—Northern States Power Company of Wisconsin, Eau Claire, contemplates extensions and improvements in its local system.

STETSONVILLE, WIS.—Arrangements have been made by the Northern States Power Company of Wisconsin, Eau Claire, for erecting a 13,200-volt transmission line from Dorchester, a distance of 10 miles, to furnish electricity in Stetsonville and to farming communities along the line.

MINNEAPOLIS, MINN.—The City Council is considering the installation of ornamental lamps on University Avenue similar to those on the St. Paul portion of University Avenue.

ROCHESTER, MINN.—Plans are under consideration for extensions and improvements in the municipal electric power plant and system including the installation of new equipment.

ST. PAUL, MINN.—The City Council has authorized the installation of ornamental lamps on Osceola Avenue from Hamline to Albert Avenue, and on Saratoga, Pascal and Albert Avenues, between Osceola and Fairmount Avenues.

BANTRY, N. D.—The installation of a municipal electric light plant is under consideration by the City Council.

ELLENDALE, N. D.—Plans are being considered by the Ellendale Electric Company for replacing the two present units in its power plant with a generating unit of 450 hp.

UPHAM, N. D.—The City Council has awarded a contract to the Electric Construction Company, Grand Forks, for building a municipal electric plant and distribution system, to cost about $15,000.

VALLEY CITY, N. D.—Plans are being considered by the City Council for extensions to the ornamental lighting system.

BRIDGEPORT, NEB.—The Western Public Service Company, Colorado Springs, Colo., plans to install additional equipment at its local plant.

NELIGH, NEB.—The Tri-State Utilities Company, Minneapolis, contemplates rebuilding its local electric plant and distribution system.

Southern States

GREENSBORO, N. C.—The question of placing electric lamps along the highway the entire distance between Greensboro and High Point is under consideration by the Chamber of Commerce.

MONROE, N. C.—Bonds to the amount of $200,000 have been authorized part of the funds to be used for extensions and improvements in the municipal electric system.

MORGANTOWN, N. C.—The Table Rock Furniture Company plans the installation of electric power equipment at its proposed new plant addition, estimated to cost $150,000.

DUNEDIN, FLA.—Bids will be received by the Mayor and the Council until Dec. 8 for furnishing material and installing an ornamental lighting system, covering about 12,000 ft.

KISSIMMEE, FLA.—An election will be held on Dec. 5 to vote on the proposal to issue $30,000 in bonds for the installation of an electric lighting system, including ornamental lamps.

NEW PORT RICHEY, FLA.—Plans are being prepared for the installation of an ornamental lighting system on Main Street and the Boulevard, to cost about $22,000.

ST. PETERSBURG, FLA.—Plans are under way by the Pinellas Power Company for extensions in its hydro-electric plant on the Withalcoochie River, to cost about $2,000,000. A 60,000-volt transmission line is also planned.

CHICKASAW, ALA.—Plans for the proposed local lumber mill to be erected by the J. M. Card Lumber Company, Chattanooga, Tenn., at a cost of about $350,000, include a power plant.

GOODWATER, ALA.—The Alabama Power Company, Birmingham, contemplates extensions in its transmission line in this section for commercial service.

LUVERNE, ALA.—Permission has been granted the River Falls (Ala.) Power Company to erect a transmission line from Brantley to Luverne, and approval of contract between the company and the town of Luverne for electrical service.

RIPLEY, MISS.—The Ripley Light Company plans to install additional equipment in its plant.

NEW ORLEANS, LA.—Ordinances have been passed by the City Council providing for the installation of ornamental lamps on Gilbert Avenue from Peebles Corner to the viaduct and on Clifton Avenue from McMillan Street to Ludlow Avenue.

TISHOMINGO, OKLA.—Plans are under way by the Oklahoma Gas & Electric Company, Oklahoma City, for the erection of a 33,000-volt transmission line connecting Tishomingo with the Ardmore-Durant high-tension line.

TULSA, OKLA.—Plans for the proposed brick factory to be erected by the Acme Brick Company, Mid-Continent Building, include a power plant.

CAMERON, TEX.—The Dallas Power & Light Company, Dallas, has acquired the plant of the Cameron Water, Light & Power Company and plans to extend its high-tension transmission line from Temple to Cameron and to a number of other towns in this section.

MADISONVILLE, TEX.—The Western Public Service Company, Navasota, which has acquired the municipal electric plant, plans to extend its transmission line from Navasota to furnish service here.

MARTINDALE, TEX.—The Texas Utilities Company, Plainview, is planning extensions in its transmission line in this district.

SAN BENITO, TEX.—The installation of a new generating unit to increase the output of its power plant from 7,500 to 13,700 hp. is contemplated by the Valley Electric & Ice Company.

VERNON, TEX.—The Vernon Electric & Ice Company plans to install additional equipment in its power plant.

SWEETWATER, TEX.—Plans are being considered by the Sweetwater Ice & Cold Storage Company and the West Texas Electric Company to double the capacity of the present ice plant, and also to erect a transmission line from here to Snyder, a distance of 40 miles. The cost is estimated at $250,000.

VICTORIA, TEX.—Work will soon be started by the Central Power & Light Company, Chemical Building, St. Louis, on the construction of a dam across the Guadalupe River, near Victoria, and an electric power plant, to cost about $1,000,000.

Pacific and Mountain States

BELLINGHAM, WASH.—The Whatcom County Power & Light Company, Ferndale, plans to erect a 6-mile power line on the Pleasant Valley Road, near the city limits.

MOUNT VERNON, WASH.—The Puget Sound Power & Light Company, Seattle, plans to erect a power line on the Pacific Highway and Cedardale Road in this section.

PORT ANGELES, WASH.—Bids will be received by the Port of Port Angeles, until Dec. 9 for an electrically-operated hammerhead crane of five tons capacity, with a 95-ft. radius and a 40-ft. clearance under the boom.

SEATTLE, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 1, for five motor-generators for the Puget Sound Navy Yard (Schedule 4637).

SEATTLE, WASH.—The Puget Sound Power & Light Company plans to lay a submarine cable line under Puget Sound to connect with the system of the Northwestern Power & Manufacturing Company in Clallam and Jefferson Counties.

MONROVIA, CAL.—The Board of Trustees has approved the petition to install ornamental lamps on Wild Rose, Oakdale, Lime and Leman Avenues. Concrete posts with single globes are to be used.

OROVILLE, CAL.—Preliminary steps have been taken by the Board of Trustees relative to the purchase of the local system of the Pacific Gas & Electric Company, to be owned and operated by the city.

OGDEN, UTAH.—The American Can Company, 120 Broadway, New York, plans to install electric power equipment in the proposed addition to its local plant, to cost about $200,000.

PHOENIX, ARIZ.—Bonds to the amount of $1,000,000 have been issued by the Roosevelt Water Conservation District, the proceeds to be used for canal construction, installation of electrical equipment, etc.

DENVER, COL.—Surveys have been completed by the Department of Parks and Improvements for the installation of a street-lighting system at Inspiration plant.

HAGAN, N. M.—Work will soon be started by the Hagan Power Company on the erection of a high-tension transmission line from Hagan to Golden, a distance of 10 miles, to furnish power to mining properties there.

Canada

FORT ALEXANDER, MAN.—Arrangements have been made whereby the Manitoba Power Company, Winnipeg, will supply power to the Manitoba Pulp & Water Company at Fort Alexander from its power plant at Great Falls. The power company plans to purchase new equipment and to erect transmission lines, to cost about $2,000,000.

CHATHAM, ONT.—The erection of an extension to the rural Hydro line along the River Road in Dorn Township, as far as Paincourt, is under consideration. Other extensions are contemplated on the River Road line below Prairie Siding to the third concession and the Harwich line to the Howard town line, thence to Kent Bridge.

KITCHENER, ONT.—The power plant of the Algoma Power Company at Michipicoten Falls, has been acquired by the Insull interests of Chicago, which plan further development work, involving an ultimate expenditure of $4,000,000. The plans provide for a new power house at Michipicoten Falls with a capacity of 25,000 hp.

TIMMINS, ONT.—Bonds to the amount of $6,000,000 have been authorized by the Northern Canada Power Company, of which $4,500,000 will be used for refunding purposes and the remainder for the erection of transmission lines in Rouyn and Gowganda.

Electrical Patents

Announced by U. S. Patent Office

(Issued November 3, 1925)

1,560,118. ELECTRIC SWITCH; E. R. Stoekle, Milwaukee, Wis. App. filed Sept. 12, 1921. Fluid-contact type.

1,560,119. THERMALLY OPERATED CIRCUIT CONTROLLER; E. R. Stoekle, Milwaukee, Wis. App. filed Sept. 12, 1921.

1,560,127. CIRCUIT CONTROLLER ATTACHMENT FOR CLOCKS; J. S. Wiggins, Haworth, N. J. App. filed March 10, 1924.

1,560,148. SWITCH FOR ELECTRIC SADIRONS; G. J. Easter, Niagara Falls, N. Y. App. filed April 12, 1922.

1,560,165. HIGH-TENSION SWITCH; T. F. Johnson, Jr., Atlanta, Ga. App. filed Nov. 17, 1923.

1,560,177. ELECTRICAL SWITCH; A. Linard, Middle Brighton, near Melbourne, Victoria, Australia. App. filed Jan. 18, 1923. Dimmer switch.

1,560,183. VACUUM TUBE; F. S. McCullough, Wilkinsburg, Pa. App. filed Dec. 11, 1922.

1,560,198. ATTACHMENT PLUG; R. B. Benjamin, Chicago, Ill. App. filed May 18, 1922.

1,560,206. METHOD AND SYSTEM FOR THE TRANSMISSION OF RADIANT ENERGY; E. L. Chaffee, Belmont, Mass. App. filed April 25, 1918.

1,560,216. MOTOR CONTROLLER; A. J. Cline and T. I. Dekle, Chicago, Ill. App. filed June 7, 1923.

1,560,226. AUTOMATIC RESPONDING AND RECORDING DEVICE FOR TELEPHONE; S. Fisher, Westport, Conn. App. filed Sept. 1, 1921.

1,560,245. TELEPHONE SYSTEM; L. D. Kellogg, Deerfield, Ill. App. filed Aug. 13, 1919. Automatic.

1,560,250. ELECTROLYTIC CELL; I. H. Levin, New York, N. Y. App. filed Oct. 4, 1921.

1,560,265. INCANDESCENT ELECTRIC LAMP FOR PROJECTION PURPOSES; D. Lely, Jr., Eindhoven, Netherlands. App. filed March 30, 1921.

1,560,278. PORTABLE APPARATUS FOR IDENTIFYING ELECTRIC CONDUCTORS; W. J. Mahan, New Haven, Conn. App. filed Jan. 23, 1924.

1,560,284. POLE-CHANGER SWITCHING CIRCUIT; J. F. Meyers, Chicago, Ill. App. filed Oct. 1, 1923. Duplicate apparatus with automatic switching from one to the other.

1,560,292. RADIO-FREQUENCY AMPLIFIER; S. Cohen, Brooklyn, N. Y. App. filed Sept. 8, 1924.

1,560,294. ELECTRIC HEATING APPARATUS; H. Geisenhöner, Schenectady, N. Y. App. filed Nov. 25, 1922. In which the heated article itself is included in the heating circuit.

1,560,308. ELECTRICAL SWITCH; C. L. Perry, Schenectady, N. Y. App. filed Oct. 19, 1923. Large-capacity, contactor type.

1,560,316. CABLE SPLICE; H. Prince, Buffalo, N. Y. App. filed April 3, 1924.

1,560,344. DYNAMO-ELECTRIC MACHINE; J. B. Frawley, Pittsfield, Mass. App. filed Jan. 16, 1924. Brush-raising and commutator short-circuiting type.

1,560,377. ELECTRIC AIR HEATER; H. H. Daley, San Francisco, Cal. App. filed May 5, 1924.

1,560,378. MULTIPLE-CIRCUIT, DOUBLE-THROW SWITCH; E. G. Danielson, San Francisco, Cal. App. filed July 18, 1921.

1,560,382. ELECTRIC MOTOR-CONTROL SYSTEM; A. H. Jackson, Muswell Hill, England. App filed May 8, 1925.

1,560,390. SPARK GAP; J. G. Liebel and E. S. Flarsheim, Cincinnati, Ohio. App. filed Sept. 24, 1923. For use with high-frequency electric machines.

1,560,395. CONTROLLING MEANS FOR FARM-LIGHTING PLANT; T. Monk, Crete, Ill. App. filed April 11, 1922.

1,560,431. SIGNALING SYSTEM; A. Schmidt, Jr., Schenectady, N. Y. App. filed July 3, 1923.

1,560,440. ELECTRIC SWITCH; J. F. Tritle, Schenectady, N. Y. App. filed Oct. 28, 1921. Trip-free type.

1,560,459. ELECTRIC METER; H. T. Worrall, Chelmsford, England. App. filed Feb. 2, 1923. Ammeter and voltmeter of the moving-iron type.

(Issued November 10, 1925)

1,560,528. HOT-WATER-HEATING SYSTEM; F. G. Baum, San Francisco, Cal. App. filed April 25, 1924.

1,560,531. AUTOMATIC SWITCH; W. G. Blauvelt, New York, N. Y. App. filed May 24, 1924. For telephone system.

1,560,534. ELECTRIC SWITCH; G. A. Burnham, Saugus, Mass. App. filed Aug. 18, 1920. For control of electric circuits of comparatively high voltage and current-carrying capacity.

1,560,543, 1,560,544. TESTING CIRCUITS FOR ECHO SUPPRESSORS; G. Crisson, Hackensack, N. J. App. filed Oct. 25, 1923.

1,560,553. ELECTRIC SWITCH; C. T. Evans, Milwaukee, Wis. App. filed May 26, 1921. With a magnetic field for blow-out or other purposes.

1,560,578. BREAD TOASTER; F. E. Hummel and J. J. Noeth, Chicago, Ill. App. filed Feb. 4, 1924.

1,560,580. ELECTRIC STARTING MOTOR SWITCH; H. L. Joyce, South Orange, N. J. App. filed Feb. 14, 1925.

1,560,597. AUTOMATIC CUT-OUT; E. Meierjohan, Cincinnati, Ohio. App. filed April 18, 1922.

1,560,600. CONTROLLER FOR ELECTRIC MOTORS; N. L. Mortensen, Milwaukee, Wis. App. filed April 17, 1924.

1,560,602. CIRCUIT-CONTROLLING MEANS; C. A. Nelson, Brooklyn, N. Y. App. filed Jan. 27, 1922. Toggle switch.

1,560,603. ELECTRIC HEATER; F. G. Niece, Cleveland, Ohio. App. filed Oct. 10, 1923. Rotary.

1,560,610. SUPERVISORY CIRCUITS; H. F. Shoffstall, New York, N. Y. App. filed Nov. 12, 1921. For telephone lines.

1,560,633. IGNITING DEVICE FOR FURNACES; A. M. Allen, Minneapolis, Minn. App. filed Oct. 8, 1921.

1,560,643. MICROPHONE BUTTON; W. H. Barber, Melrose, Mass. App. filed Dec. 15, 1921. Submarine signaling.

1,560,652. CONTROL SYSTEM; H. L. Blood, North Plainfield, N. J. App. filed May 24, 1923. For operating planers and other machine tools.

1,560,686. RECORDING PHONOGRAPH; R. Hase, Berlin, Germany. App. filed Feb. 18, 1921. Electrically operated.

1,560,692. ELECTRON DISCHARGE DEVICE; W. G. Housekeeper, New York, N. Y. App. filed June 13, 1923.

1,560,695. ELECTRIC WATER HEATER; W. Kiger, St. Louis, Mo. App. filed Jan. 24, 1925.

1,560,698. PUSH BUTTON AND ART OF MAKING THE SAME; K. Knudsen, Danbury, Conn. App. filed April 2, 1923.

1,560,699. WELDING MACHINE; A. A. Kramer and A. M. Griffin, Kansas City, Mo. App. filed Nov. 9, 1923. Electric arc.

1,560,724. REGULATING SYSTEM; L. M. Potts, Highwood, N. J. App. filed Oct. 26, 1922. For governing the speed of electric motors.

1,560,725. AUTOMATIC TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed Jan. 25, 1922.

1,560,726. TELEPHONE SUBSTATION CIRCUIT; W. T. Powell, Rochester, N. Y. App. filed July 24, 1923. For conversion from local to common battery operation.

1,560,727. TESTING SYSTEM; H. M. Pruden, East Orange, N. J. App. filed Jan. 23, 1923. For testing the adjustment of polarized relays, interrupters and the like.

1,560,730. SOUND RECORDATION; M. H. Reno, Pittsburgh, Pa. App. filed Jan. 30, 1922. For increasing the efficiency of commercial recording machines.

1,560,740. ELECTRON DISCHARGE DEVICE; J. L. Stelling, Brooklyn, N. Y. App. filed July 12, 1923.

1,560,750. OPERATOR FOR USE IN SPEED INDICATOR SYSTEMS; F. W. Wood, Montclair, N. J. App. filed Jan. 21, 1921.

1,560,760. ENGINE CONTROL MEANS; M. P. Chaplin, White Plains, N. Y. App. filed Oct. 26, 1922. Speed-control devices for an internal-combustion engine operating a dynamo-electric machine.

1,560,762. ELECTRIC MOTOR; G. B. Coleman, San Francisco, Cal. App. filed July 2, 1921.

1,560,774. RELAY; J. S. Garvin, Bogota, N. J. App. filed Dec. 27, 1923. Armature construction.

1,560,777. ATTACHABLE INDICATOR FOR FUSES; J. B. Glowacki, Chicago, Ill. App. filed March 9, 1922.

1,560,778. ANTI-INDUCTION DEVICE; F. M. Goddard, Brooklyn, N. Y. App. filed Sept. 22, 1921. For preventing magnetic disturbances in adjacently placed electromagnetic devices.

1,560,803. RELAY; J. J. Miller, New York, N. Y. App. filed Sept. 6, 1924. Voice-frequency relays.

1,560,810. TIME SWITCH; S. L. Stone and R. C. Braendlein, Indianapolis, Ind. App. filed May 8, 1922. To open or close electric circuits at stated intervals.

1,560,822. AUTOMATIC TELEPHONE SYSTEM; E. Jacobsen, Chicago, Ill. App. filed Feb. 11, 1918.

1,560,839. MAGNETO; J. L. Milton, Louisville, Ky. App. filed Jan. 12, 1921.

1,560,858. AUTOMATIC TELEHONE SYSTEM; R. G. Richardson, Chicago, Ill. App. filed Nov. 23, 1920. Finder switches.

1,560,883. ELECTRIC SWITCH; A. Volland, Burlington, Kan. App. filed Jan. 26, 1923

1,560,893. WAX AND COMPOUND ANNEALER; H. A. Bonoff, Los Angeles, Cal. App. Nov. 20, 1924.

1,560,932. THERMAL RESPONSIVE CIRCUIT CONTROLLER; J. Eaton, Schenectady, N. Y. App. filed Aug. 27, 1923.

1,560,934. ALTERNATING ELECTRIC CURRENT PROTECTIVE APPARATUS; A. S. Fitz Gerald, Finchley, England. App. filed July 18, 1923.

1,560,936. MERCURY-VAPOR DEVICE; J. Force, Livingston, N. J. App. filed July 11, 1922.

1,560,951. FLOW METER AND THE LIKE; L. W. Thompson and J. W. McNairy, Schenectady, N. Y. App. filed April 17, 1923.

1,560,981. MANUFACTURE OF INCANDESCENT LAMPS; A. De Graaff and Dirk Lely, Jr., Eindhoven, Netherlands. App. filed Nov. 17, 1920.

1,560,998. HIGH-TENSION SWITCH MECHANISM; C. G. Koppitz, Greensburg, Pa. App. filed July 24, 1924.

1,561,001. ELECTRIC OSCILLATOR; I. Langmuir, Schenectady, N. Y. App. filed Feb. 7, 1921.

1,561,017. METHOD OF STARTING ALTERNATING-CURRENT MOTORS; W. E. Paul, Schenectady, N. Y. App. filed May 23, 1922.

1,561,038. HEATING MEANS; G. Wade, Newark, N. J. App. filed May 25, 1925. Hydro-electric radiator for heating purposes.

1,561,055. ELECTRO-WELDING GRIP; R. J. Callahan, Newark, N. J. App. filed Nov. 8, 1924.

1,561,115. IMPULSE TRANSMITTER; J. J. Ruddick, West Newton, Mass. App. filed Dec. 22, 1920. Operated by a motor controlled by a winding mechanism.

1,561,145. ELECTRICAL DEVICE; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Oct. 24, 1917. Reinforcement of energy-deflected systems.

1,561,146. BALANCED ELECTROSTATIC PHASE CONVERTER; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Feb. 5, 1921.

1,561,147. ELECTRICAL MEASURING DEVICE; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Oct. 24, 1917. For improving the performance of electrical measuring systems.

1,561,162. SOCKET TERMINAL; L. E. Isele, Glen Ridge, N. J. App. filed Feb. 4, 1922.

1,561,197. MAGNETIC CARBON HOLDER; W. Wenderhold, New York, N. Y. App. filed Oct. 29, 1917.

1,561,204. TRANSFORMER; R. F. Beers, Brooklyn, N. Y. App. filed July 26, 1923. Reduced magnetic leakage and capacity unbalances between windings.

1,561,224. ELECTRICAL SOLDERING DEVICE; R. Fritsche, Lippstadt, Germany. App. filed Oct. 8, 1924.

1,561,225. METHOD AND MEANS FOR MEASURING TIME; J. R. Fry, New York, N. Y. App. filed March 11, 1924. Measuring the time it takes a circuit or relay to function after it has been energized or de-energized.

1,561,227. CARRIER-CURRENT SIGNALING SYSTEM; E. V. Griggs, East Orange, N. J. App. filed March 31, 1923. Employing speech-frequency carrier current.

1,561,234. AUTOMATIC SUPERVISORY SIGNALING SYSTEM; R. M. Hopkins, Rutherford, N. J. App. filed Sept. 17, 1918. For sprinkler or other water supply installations.

1,561,239. SWITCH; O. S. Jennings, Brooklyn, N. Y. App. filed Sept. 8, 1920. Inclosed cut-out switches, safety type.

1,561,240. CONTROL APPARATUS; H. H. Johnston, Edgewood Park, Pa. App. filed July 7, 1920. Overload protective device for electric railway motors and the like.

1,561,243. CONTROL FOR HEATING SYSTEMS; A. D. Kenne, Pittsburgh, Pa. App. filed Jan. 5, 1924.

1,561,249. SPARK-GAP LIGHTNING ARRESTER; S. B. Kraut, East Pittsburgh, Pa. App. filed April 7, 1922. Built-up units.

1,561,251. CONTROL SYSTEM; E. S. Lammers, Jr., Elyria, Ohio. App. filed May 12, 1919. Automatic and manual.

1,561,263. VOLTAGE REGULATOR; H. A. Maxfield, Wilkinsburg, Pa. App. filed Sept. 23, 1921. Vibratory type.

1,561,265, 1,561,266, 1,561,267, 1,561,268. SPEED-REGULATOR SYSTEM; W. E. Menzies, Irwin, Pa. App. filed Jan. 12, 1920.

1,561,270. BUSBAR; D. F. Miner, Wilkinsburg, Pa. App. filed Sept. 17, 1920. To compensate for skin effect.

1,561,276. FLUID HEATER; C. C. Pankratz, Orange, Cal. App. filed Jan. 13, 1925.

Financial and Corporate

Utility Market Improves

Gains of Two and Three Points Shown by Numerous Issues—Northern States Strong

ACTIVITY on the New York Stock Exchange diminished during the week under review as a result of caution pending decision on the discount rate. Up to three weeks ago a 4 per cent discount rate prevailed at seven and a 3½ per cent rate at five of the Federal Reserve banks, the institutions maintaining the lower rate being those at Boston, New York, Cleveland, San Francisco and Philadelphia. Four of these five now have raised their rates to 4 per cent, and the market appears to have reconciled itself more or less to the change. While bullish manipulations have been curtailed by the action of the banks, fortunately the constructive forces still dominate in the market for all leading groups of securities. In the last week, however, the attention has turned from the industrials to the public utilities and the rails.

On the big board American Water Works & Electric has made a smart recovery, the stock within a brief period having moved from a level below 50 to a price of 62 on persistent accumulation following flotation of an eight-million-dollar bond issue by that company. On the New York Curb Market and over the counter interest was lively in some of the shares such as Electric Investors, Inc., which improved its position for a time and then, on the announcement of a 10 per cent stock dividend, was liquidated and lost ground. Persistent accumulation of Electric Railway Securities followed the announcement of Hodenpyl, Hardy & Company that a distribution of certain assets had been planned to stockholders of Electric Railway Securities through the formation of a new company. Electric Railway Securities advanced in good style. Northern States Power continued strong on reports of a favorable character, that stock having improved its position last week by more than seven points. National Power & Light and Carolina Power & Light each added about twelve points to their position of the week before. American Light & Traction, Commonwealth Power, Lehigh Power and United Light & Power all advanced.

New German Loan Floated

One of the most important producers and distributors of electricity in Germany, the Westphalia United Electric Power Corporation, made an offering on Tuesday of first mortgage sinking-fund gold bonds to the amount of $7,500 000. These bonds, dated December 1, 1925, and maturing December 1, 1950, were priced at 87½ and interest, to yield 7.62 per cent. The company supplies by far the greater part of all the electricity used in one of the foremost industrial sections of Europe, serving directly over 138,000 customers in more than 240 communities, and supplies at wholesale most of the power requirements of various local distributing systems which in the aggregate supply electricity to about 160,000 additional customers in 106 communities.

Company Reports

The following statement of earnings have been issued by electric light and power companies for the month of October:

Name of Company	Gross Earnings for October 1925	1924
American & Foreign Power*...	$758,554	$571,983
Central Maine Pwr. Co. Sys...	356,114	332,984
Cities Service.....	1,421,388	1,163,814
Columbia Gas & Electric.....	2,929,522	1,938,060
Kansas City Power & Light...	867,212	772,874
Massachusetts Lighting.....	329,220	312,614
United Gas & Electric.....	1,240,437	1,151,529
Washington Water Power.....	527,092	440,187

* September

September Customers' Sales Total $20,800,000

Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock direct to customers and employees, it is estimated that during September a total of 206,500 shares were sold in this manner. The total value of the stock sold is estimated at $20,800,000, which is $1,100,000 under the sales reported in September, 1924. A total of 28,450 customers participated in the sales during September.

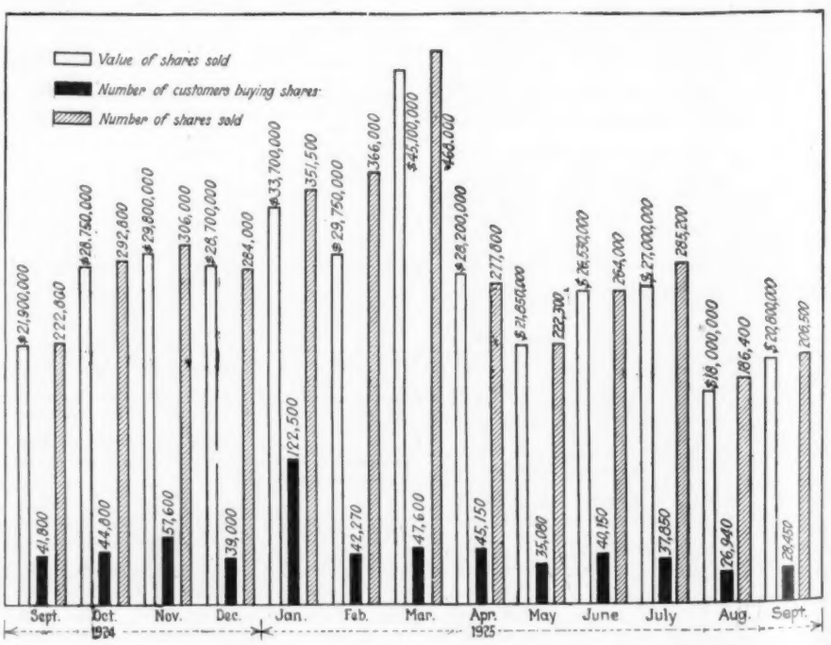
New Capital Issues

During the past week the United Light & Power Company issued 6 per cent gold debentures at 92 and accrued interest, to yield about 6.55 per cent, a piece of financing involving a total of $12,500,000.

Also represented in the week's activities was the Columbus Railway, Power & Light Company, which issued $2,500,000 in 6 per cent cumulative first preferred stock (par $100), the price being $100 per share. Proceeds from the sale of this stock are to be used for the partial retirement of floating debt and toward the completion of the Columbus company's new Picway power station.

A syndicate composed of Stone & Webster, Inc., Blair & Company, Inc., Brown Brothers & Company and Blodget & Company announce the sale, prior to a public offering, of a new issue of first and refunding mortgage 5 per cent gold bonds of the Virginia Electric & Power Company, totaling $3,000,000. The bonds were priced at 92½ and interest.

Recent Listings. — The New York Stock Exchange has authorized the listing of: North American Company 6 per cent additional cumulative preferred stock amounting to $1,250,000 and additional common stock amounting to $2,940,000; Public Service Corporation of New Jersey 6 per cent cumulative preferred stock amounting to $11,800,300; 69,133 additional shares of capital stock of the American Bosch Magneto Corporation; 50,000 additional shares of



ELECTRIC LIGHT AND POWER COMPANIES SOLD 206,500 SHARES TO CUSTOMERS IN SEPTEMBER

common stock of the Weston Electrical Instrument Corporation; Portland Electric Power first lien and refunding mortgage gold bonds, series B, 6 per cent, totaling $500,000; West Penn Power 6 per cent cumulative preferred stock amounting to $5,000,000; 962,252 shares of common stock of the Ingersoll-Rand Company. There have been placed on the Boston Stock Exchange list temporary bonds for $450,000 first-mortgage, series A, 6 per cent gold bonds of the South Carolina Power & Light Company. The Boston Exchange has also authorized the listing of $1,000,000 first mortgage 5½ per cent gold bonds, series A, of the West Kentucky Electric Power Company.

Georgia Railway & Power's Set-Up

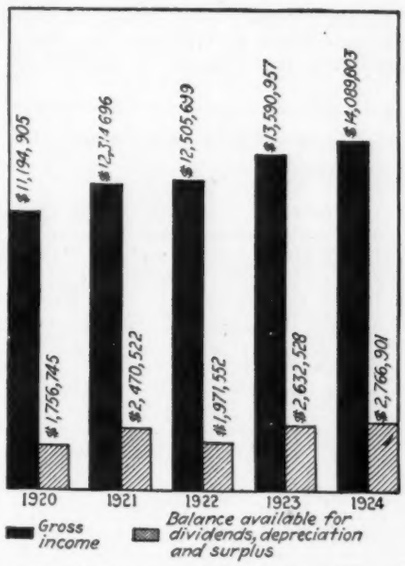
Utility's Gross Annual Income Now Totals $14,769,000—Serves Atlanta and About Forty Other Communities in Northern Part of Georgia

BY PAUL WILLARD GARRETT

ATTENTION is called anew to the Georgia Railway & Power Company through its flotation of a four-million-dollar issue of 7 per cent cumulative first preferred stock. Organized about fifteen years ago to develop the water power of the Tallulah and Tugalo Rivers in northern Georgia, the company during that period has constructed reservoirs with a storage capacity of more than 7,000,000,000 cu.ft. and power plants capable of an average annual output of 500,000,000 kw.-hr. Extensive development of the territory has made necessary expansions in the facilities of the plant, and, of course, these physical enlargements have modified the capital structure somewhat over a period of years. It is to be noted that the Georgia Railway & Power Company serves Atlanta and approximately forty other communities in the northern section of the State of Georgia. The district served by the company is one that has shared in the recent growth of that part of the country. Georgia Railway & Power is the only general power producing and distributing company in its field. It operates the properties of the Georgia Railway & Electric Company under a long-term lease, as it does also those of the Atlanta Gas Light Company.

The consolidated balance sheet for the Georgia Railway & Power Company as of August 31, 1925, but modified to reflect the new financing, shows total assets for the utility of $117,276,116, and of that total no less than $103,530,798 represents plant and equipment.

Total capital liabilities aggregated $97,746,600. Interesting enough, these total capital liabilities are about evenly divided between stocks and bonds. In other words, the system has capital liabilities of $50,314,600 in stock in the hands of the public and $47,432,000 in bonds outstanding in the hands of the public. Counting $6,902,549 which on the consolidated balance sheet appears as reserves for renewals and replacements, $1,024,336 as other reserves and $6,716,186 as surplus, a total of $14,643,071 is shown in the shape of reserves and surplus. From the standpoint of its distribution of stocks and bonds, in a ratio that is clearly conservative, and the substantial reserves and surplus, the financial structure of the Georgia Railway & Power system is impressive. On completion of the present financing the system's capital set-up will be about as follows: Its $47,432,000 in funded debt will represent $27,254,000 in bonds of the Georgia Railway & Power Company, $16,832,000 of the Georgia Railway & Electric Company, $2,946,000 of the Atlanta Gas Light Company and $400,000 of the Atlanta Northern Railway Company. Its $50,314,600 of capital stock outstanding in the hands of the public will include two



GROSS INCOME OF GEORGIA RAILWAY & POWER SHOWS CONSISTENT GROWTH

issues ($2,400,000 in 5 per cent preferred and $8,514,600 in 8 per cent common) of the Georgia Railway & Electric Company, aggregating $10,914,600. In addition there will be four different issues of stock on which will appear the name of the Georgia Railway & Power Company itself. These will be as follows: $10,500,000 of cumulative first preferred 7 per cent stock (including the new issue), $3,900,000 of cumulative first preferred 8 per cent stock, $10,000,000 non-cumulative second preferred stock now paying 4 per cent, and $15,000,000 of common stock now paying 4 per cent.

Gross income has grown from $11,194,905 in 1920 to $14,769,496 for the twelve months ended August 31, 1925, and the balance available for dividends, depreciation and surplus from $1,756,745 to $2,888,452. In connection with the recent financing it was figured that the company was earning at the rate of more than two and three-quarters times dividend requirements on the first preferred stock presently to be outstanding.

Dividends Declared

The quarterly dividends listed below were announced during the past week by electric light and power companies and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Baton Rouge Elec., com	.62½	Dec. 1
Cities Service, com.*	½	Jan. 1
Cities Service, pf. & pf. B*	½	Jan. 1
Cities Service, com.†	½	Jan. 1
Electric Investors, com.‡	....	Jan. 2
Engineers' Public Service, pf.	$1.75	Jan. 2
Fairbanks, Morse & Co., com	.65	Dec. 31
General Electric	2	Jan. 15
General Electric, special	15	Jan. 15
Kansas City Pwr. & Lt., 1st pf., A	$1.75	Jan. 1
Kentucky Hydro-Electric, pf	1¾	Dec. 21
National Power & Light, pf	$1.75	Jan. 2
Niagara, Lockport & Ont. Pwr., cm.	.50	Jan. 1
Niagara, Lockport & Ont. Pwr., pf.	1¾	Jan. 1
Nizer Corporation, com	.50	Jan. 1
Nizer Corporation, class A	.75	Jan. 1
Nizer Corporation, class B‖	....	Jan. 15
Northern Texas Electric, com.	$1	Dec. 1
Ohio Edison, 6% pf	$1.50	March 1
Ohio Edison, 6.6% pf	$1.65	March 1
Ohio Edison, 7% pf	$1.75	March 1
Ohio Edison, 6.6% pf*	.55	Jan. 2
Ohio Edison, 6.6% pf*	.55	Feb. 1
Ohio Edison, 6.6% pf.*	.55	March 1
Southeastern Mass. Power & Lt.	$2.25	Nov. 15
United El. Lt. (Wilmerding, Pa.), cm.	2	Nov. 15
United El. Lt. (Wilmerding, Pa.) pf.	1¾	Nov. 15
Vesta Battery, pf	1¾	Dec. 1
West Penn Company, com	$1	Dec. 31

* Monthly. † Payable in common stock. ‡ One-tenth share of common stock. ‖ Payable in class B stock.

Weston Instrument Calls Debentures.—The Weston Electrical Instrument Corporation has called for redemption January 1 at 105 and interest all of the outstanding fifteen-year 6 per cent sinking-fund gold debentures amounting to $790,000. The debentures matured January 1, 1940.

Pacific Lighting to Expand.—According to a statement recently made by C. O. G. Miller, president of the Pacific Lighting Corporation, the directors have proposed to give all holders of the 5 per cent preferred stock an opportunity to exchange it, share for share, for 6 per cent preferred, on surrender of their certificates and payment of $10 a share with adjustment of accrued dividends. The new authorized capital structure will be for a total par value of $100,000,000 against the present $20,000,000. There will be 50,000 shares of 5 per cent preferred, 250,000 shares of 6 per cent preferred and 70,000 shares of common, all having a par value of $100.

North American Company Reports Large Reserves and Surplus.—Reserves and surplus of the North American Company totaled $78,171,070 as of September 30, 1925, an increase of $13,983,268 during the twelve months, according to the consolidated balance sheet made public last Monday. Property and plant account amounted to $315,415,395, an increase during the twelve months of $41,081,884. Current assets, amounting to $40,150,655, exceeded current and accrued liabilities by $11,379,228. Common stock of the North American Company increased $2,956,990 during the twelve months, while funded debt and preferred stock of subsidiary companies increased $15,141,936 and $11,451,110 respectively. "In accordance with long-established policy," said Frank L. Dame, president of the North American Company, "rea-

sonable proportions of earnings are appropriated for depreciation and other reserves, as indicated by the net increase of $6,561,552 in reserves which on September 30, 1925, amounted to $50,805,265. After appropriations for all reserves and the payment of dividends on the preferred and common stock of the North American Company, surplus increased $7,421,716 and amounted to $27,365,805. The consolidated balance sheet does not include Western Power Corporation or Mississippi River Power Company, or their subsidiaries, for the control of which negotiations were only recently concluded."

Milwaukee Electric to Change Set-up.—The board of directors of the Milwaukee Electric Railway & Light Company has recommended the adoption of certain amendments to the articles of incorporation and has called a special meeting of stockholders for December 21 to vote upon the proposals. The plan calls for an increase in the authorized preferred capital stock from the present amount of $20,000,000 to $40,000,000, to consist of $4,500,000 of 6 per cent preferred capital stock and $35,500,000 of preferred capital stock, issue of 1921. The directors also recommended that the authorized common capital stock be increased from the present amount of $20,000,000 to $40,000,000 and that the par value be changed from $100 per share to $20 per share.

Florida Utility Calls Bonds.—The Daytona (Fla.) Public Service Company has called for payment January 1 at 110 and interest all of the outstanding twenty-year sinking-fund first mortgage 7 per cent gold bonds dated January 1, 1922.

Consolidated Gas of Baltimore to Issue Stock.—To provide funds for construction and to reimburse the treasury the Consolidated Gas, Electric Light & Power Company of Baltimore will in the near future issue additional common stock. The amount has not yet been determined, but it is believed that it will be between $5,000,000 and $6,000,000. According to present reports, the company is planning to offer the stock directly to stockholders and the public.

Virginia Utility Sells Stock to Customers.—Stone & Webster, Inc., have announced that the entire amount of 7 per cent cumulative preferred stock, totaling $1,000,000, of the Virginia Electric & Power Company allotted the Virginia territory for sale to local customers has been oversubscribed. Each customer was limited to twenty-five shares. This stock, while a part of the same issue, is in addition to the five-million-dollar offering described in the November 14 issue of the ELECTRICAL WORLD.

Stockholders Vote Increase in Capital.—Stockholders of the Missouri Power & Light Company have increased the capital stock from 32,000 shares of preferred stock, par $100 each, and 40,000 shares of common stock of no par value to 57,000 shares of preferred stock, par $100, and 60,000 shares of common stock of no par value.

San Joaquin Company to Issue Stock.—Application has been made to the California Railroad Commission by the San Joaquin Light & Power Corporation for authority to issue 5,000 shares of 7 per cent preferred stock at not less than par. Funds from the sale of this stock will be used to reimburse the treasury for additions and betterments.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Nov. 21	Low 1925	High 1925
STOCKS			
Abitibi Pwr. & Paper, com.—no par	f68¼	62	75¼
Adirondack Pwr. & Lt.—7% pf.	101	98	106
Adirondack Pwr. & Lt.—8% pf.	107	103	115
Adirondack Pwr. & Lt., com.—50	k 75	31	98
Ala. Pwr., pf.	104	97½	103
Allis-Chalmers Mfg. pf.	107	103½	108½
Allis-Chalmers Mfg., com	f 88¼	71¼	95
Amer. & Foreign Pwr., pf. 25% pd.	130	129½	142
Amer. & Foreign Pwr., 7% pf.	f 92½	87	94
Amer. & Foreign Pwr., com.	f 40½	27½	51⅛
Amer Bosch Magneto, com.—no par	f 28½	26½	54⅛
Amer. Brown, Boveri, ptc., stk.	f 50½	49½	53⅞
Amer. Elec. Pwr., pf.	c 101½	91½	104½
Amer. Gas & Elec., 6% pf.—no par.	91	85	91
Amer. Gas & Elec., com.—no par.	79	70	85
Amer. Lt. & Trac., 6% pf.	111	93	115
Amer. Lt. & Trac., com.	255	139	288
Amer. Pwr. & Lt., 6% pf.	94	84	95
Amer. Pwr. & Lt., com.—no par.	61	52	67½
Amer. Pub. Serv., 7% pf.	90	88	94
Amer. Pub. Serv., com.	47	45	90
Amer. Pub. Utilities, 4% pf.	80	....	....
Amer. Pub. Utilities, 6% pf.	79	71	82
Amer. Pub. Utilities, 7% pf.	87	87	95
Amer. Pub. Utilities, com.	78	70	103
Amer. Superpwr., pf.—25	f 25	....	....
Amer. Superpwr., Class A—no par.	f 24½	....	....
Amer. Superpwr., Class B—no par.	f 36	....	....
Amer. Wtr. Wks. & Elec., 7% pf.	f100½	98	103
Amer. Wtr. Wks. & Elec., com.	f60	34½	68½
Appalachian Pwr., 7% pf.	101	92	100
Appalachian Pwr., 1st pf., 7%	101	95	101
Appalachian Pwr., com.—no par.	78	70	83
Arizona Pwr., 7% pf.	83	75	87
Arizona Pwr., com.	32	15	34½
Arkansas Cent. Pwr., pf., $7—no par	100	97	102
Arkansas Lt. & Pwr., 7% pf.	98	92	102
Arkansas Lt. & Pwr., com.	100	65	101
Asheville Pwr. & Lt., 7% pf.	f103	98	104
Assoc. Gas & Elec., 7% pf.—1% extra—50	f 50½	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 82	....	....
Assoc. Gas & Elec., Class A	f 35	....	....
Babcock & Wilcox, com.	f144	....	....
Birmingham Elec. pf.—$7—no par.	101	98	101½
Blackstone Valley Gas & Elec., com.—50	94	....	....
Brazilian Trac., Lt. & Pwr., com.	f 75½	....	....
Broad River Pwr., pf.	94	90	97
Brooklyn Edison, com.	f135½	120½	156½
Buffalo Gen. Elec., com.—no par.	k58	50	77
Buffalo, Niagara & East. Pwr., pf.—25	f 23½	....	....
Buffalo, Niagara & Eastern Pwr., com.	f29½	....	....
Carolina Pwr. & Lt., pf.—$7—no par	105	100	107
Carolina Pwr. & Lt., com.	430	290	456½
Central Ariz. Lt. & Pwr., pf.	101	100	106
Central Ark. Ry. & Lt., 7% pf.	96	91	98½
Central Ill. Pub. Serv., 6% pf.	86	84	93
Central Ind. Pwr., 7% pf.	87	88	95
Central Pwr. & Lt., pf.	93	88	95
Central States Elec., 7% pf.	93	87	98
Central States Elec., com.	220	70	225
Century Elec., com.	k103	103	110
Chicago Fuse Mfg., com., no par	a32	27½	39½
Cincinnati Gas & Elec., com.	g89½	82	90½
Cities Service, 6% pf.	83½	80	84
Cities Service, pf. B—10	f 7½	....	....
Cities Service, pf. BB—100	f 76	....	....
Cities Service, com.—20	38½	34	43
Cities Service, Bks. Shrs.—10	17½	16½	22
Cleveland Elec. Illg., 6% pf.	102	101	105
Cleveland Elec. Illg., com.	240	200	250
Colorado Pwr., 7% pf.	96	93	98
Columbia Gas & Elec., 7% pf.	f112	104½	113½
Columbia Gas & Elec., com.—no par	f 79½	45½	86
Columbia Ry., Gas & Elec., 6% pf.	90	90	90
Columbus Elec. & Pwr., 2d pf.	f100	....	....
Columbus Elec. & Pwr., com.	f148	....	....
Columbus Ry., Pwr. & Lt., pf. A	97	86	99
Columbus Ry., Pwr. & Lt., pf. B	92	80	85
Columbus Ry., Pwr., & Lt., com.	150	114	150
Commonwealth Edison, com.	a138	130½	141½
Commonwealth Pwr., 6% pf.	87	80	88
Commonwealth Pwr., com—no par.	34	30½	43½
Conn. Lt. & Pwr., 8% pf.	118	115	118
Conn. Lt. & Pwr., 7% pf.	111	105	110
Cons. Gas of N. Y., pf.	f 56	....	....
Cons. Gas of N. Y., com—no par.	f 92	74½	95½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	k104	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	c110	105	110½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	c111	109	114
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	c125	122	127½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	c 43	32	47½
Cons. Utilities of Dela., 7% pf.	k 85	80	84
Consumers Pwr., 6% pf.	96	90	97
Consumers Pwr., 6 6% pf.	101½	97	102
Continental Gas & Elec., 7% ptc. pf	95½	85	97
Continental Gas & Elec., 7% pr. pf.	96	89	95
Continental Gas & Elec., com—no par	140	77	145
Crocker Wheeler, com.	15	21	28
Crocker Wheeler, pf.	..	65	80
Dallas Pwr. & Lt., 7% pf.	101	100	102½
Dayton Pwr. & Lt., 6% pf.	95	88	100
Dayton Pwr. & Lt., com.	420	180	460
Detroit Edison, com.	f137	110	159½
Dubilier Condenser & Radio, com.	f 10	....	....
Dubuque Elec., 7% pf.	90	80	90
Duquesne Lt., 7% pf.	111	104	112
East. Tex. Elec., 7% pf.	100	100	105
East. Tex. Elec., com.—no par.	80	70	75½
Edison Elec. Illum. of Boston, com.	d209½	200	213
El Paso Elec., com.	f 74	....	....
El Paso Elec., pf.	f100	....	....
Elec. Bond & Share, 6% pf.	f104	101½	106½
Elec. Bond & Share Sec., com.—no par	f67½	56½	80½
Elec. Investors, 6% pf—no par.	92	95	96
Elec. Investors, com.—no par.	72	30	79½
Elec. Investors, 10% pd. receipts	49½	15	50
Elec. Pwr. & Lt., etfs, pf.	f 92	89½	94
Elec. Pwr. & Lt., etfs., 40% pd.	105½	100	110
Elec. Pwr. & Lt., etfs. full pd.	105	100½	110½
Elec. Pwr. & Lt., etfs., com.	f 29½	17½	40½
Elec. Storage Battery, com.—no par	f 75	60½	77
Elmira Wtr., Lt. & R.R., 7% pf.	96½	93	98
Emerson Ele., pf.	k100½	95	101½
Empire Dist. Elec., 6% pf.	80	78	85
Engr. Pub. Serv., pf.—no par.	99	100	103
Engr. Pub. Serv., com.—no par.	24	19½	30
Eureka Vacuum Cleaner, com.—no par	f 50	43½	55½
Fairbanks Morse, com.	f 49½	32½	54½
Fairbanks Morse, pf.	f110½	106½	110½
Federal Lt. & Trac., com.	f 27½	26	36
Federal Light & Traction, pf.	k 83½	82½	86½
Federal Utilities, pf.	f 75	....	....
Federal Utilities, com.	f 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	f105½	99½	107½
Galveston-Houston Elec., 6% pf.	64	70	75
Galveston-Houston Elec., com.—no par	25	20	40
Gen. Elec., com.	f310½	227½	337½
Gen. Elec., special—10	f 11½	10½	11½
Gen. Gas & Elec., 6% pf.—no par.	220	72	240
Gen. Gas & Elec., 7% pf.	165	120	175
Gen. Gas & Elec., com.—no par.	210	72	240
Gen. Gas & Elec., (Me.) pf.—$7—no par	130	90	175
Gen. Gas & Elec., (Me.) pf.—$8—no par	140	104½	180
Gen. Gas & Elec. (Del.) com. A no par	60	42	64½
Gen. Gas & Elec. (Del.) com. B no par	56	40	62
Gen. Gas & Elec. (Del.) A pf. 7% no par	95	97½	100
Gen. Gas & Elec. (Del.) A pf. 8% no par	107	90	110
Gen. Gas & Elec. (Del.) B pf. 7% no par	94	88	96
Ga. Lt., Pwr., & Rys., 6% pf.	76	74	85
Ga. Lt., Pwr. & Rys., com.	60	25	74
Ga. Ry. & Elec., 5% pf.	76	78½	84½
Ga. Ry. & Elec. com.	k124½	115½	115½
Ga. Ry. & Pwr., 8% pf.	f112	....	....
Ga. Ry. & Pwr., 7% pf.	f101	....	....
Ga. Ry. & Pwr., 4% pf.	130	62	110
Ga. Ry. & Pwr., com.	142	62	140
Gt. Western Pwr., 7% pf.	f101½	....	....
Havana Elec. Ry., Lt. & Pwr., com.	k236	112	246
Havana Elec. Ry., Lt. & Pwr., pf.	k112	112	116
Hurley Machine, com.—no par.	a 50	41½	56
Idaho Pwr., 7% pf.	100½	97½	102
Ill. No. Utilities, 6% pf.	88	82	92
Ill. Pwr. & Lt., 7% pf.	96½	92½	98
Int. Combustion Engr., com.—no par	f 54½	31½	58½
Int. Utilities, class A—no par	f 40	....	....
Int. Utilities, class B—no par.	f 8	....	....
Interstate Pwr., pf., $7, no par.	90	90	95
Interstate Pub. Serv., 7% pf.	96	90	100
Iowa Ry. & Lt., 7% pf.	97	92	100
Jersey Central Pwr. & Lt., 7% pf.	94	90	96
Jersey Central Pwr. & Lt., com.—no par	45	15	50
Johns-Manville, com.—no par.	f146	....	....
Kansas Gas & Elec., 7% pf.	f102	97½	103
Kelvinator Corp., com.—no par.	f 78½	....	....
Kentucky Hydro-Elec., com.	a 92½	85½	92½
Kentucky Sec., 6% pf.	74	67	78
Kentucky Sec., com.	82	77	87
Kentucky Utilities, 6% pf.	89	82	95
Kings County Ltg., 7% pf.	f100	....	....
Laclede Gas Lt., com.	f162	110½	178
Lehigh Pwr. Sec., cap.—no par.	f185	82	188

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. fBid, low, high, Monday, Nov. 23. jBid, low, high Wednesday, Nov. 25. kLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Nov. 21	Low 1925	High 1925
STOCKS—Continued			
Long Island Ltg., 7% pf.	105	100	105
Long Island Ltg., com—no par.	135	60	142
Los Angeles Gas & Elec., 6% pf.	95	90	98
Manila Elec., com.—no par.	37	28½	49½
Maytag Mfg., com.	‹ 22½	22	26½
Memphis Pwr. & Lt., pf., $7, no par.	102½	98½	102
Metropolitan Edison, pf.—$6—no par	92½	92	96
Metropolitan Edison, pf., $7, no par.	104	100	110
Middle West Utilities, 7% pf.	a 97½	91½	98½
Middle West Utilities, 7% pr. lien pf.	a106½	98	108
Middle West Utilities, com.—no par	a114½	92½	125
Midland Utilities, pr. ln. pf.	a100	98½	101
Milwaukee Elec. Ry. & Lt., 8% pf.	100	98	105
Milwaukee Elec. Ry. & Lt., 7% pf.	98	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	86½	83½	87
Minn. Pwr. & Lt., 7% pf.	f101	97½	102
Miss. Pwr. & Lt., pf.	‹100	....	....
Miss. River Pwr., 6% pf.	94	87½	94
Miss. River Pwr., com.	108	37	124½
Montana Pwr., pf.	‹112½	109	117
Montana Pwr., com.	‹ 80½	64	99½
Montreal Pwr., com.	f 207½	....	....
Mountain States Pwr., pf.	‹ 94	....	....
Mountain States Pwr., com.	‹ 27	....	....
National Carbon, com.	k124	120	130
National Carbon, pf.	k94½	....	....
National Elec. Pwr., pf.	a 94½	94	96½
National Lt., Ht. & Pwr., 5% pf.	71	40	72
National Lt., Ht. & Pwr., com.—no par	24	11	30
National Pwr. & Lt., pf., $7—no par	101	95	99
National Pwr. & Lt., com.—no par.	435	185	467
National Pub. Serv., 7% pf.	‹ 93	....	....
National Pub. Serv., pfc. pf.	‹ 98	....	....
National Pub. Serv., A com.—no par	‹ 25½	....	....
National Pub. Serv., B com.—no par	‹ 15	....	....
Nebraska Pwr., 7% pf.	f102½	98½	103½
Nevada-Calif. Elec., com.	‹35	....	....
N. J. Pwr. & Lt., 7% pf.	103	92	102
New Orleans Pub. Serv., 7% pf.	101	94	102
New Orleans Pub. Serv., com.—no par	k30	31	38½
N. Y. Central Elec., 7% pf.	97	96	101
Niagara Falls Pwr., 7% pf.—25	27½	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	k106	101½	110
Niagara, Lock. & Ont. Pwr., com.—no par	k 63	60	73
Nizer Corp., A.—no par.	‹ 78½	....	....
Nizer Corp., B.—no par.	‹ 79½	....	....
No. Amer., 6% pf.—50.	‹ 49½	46½	50½
No. Amer., com.—10.	‹ 65½	41½	75
No. Caro. Pub. Serv., pf.—$7—no par.	90	90	96
No. N. Y. Utilities, 7% pf.	‹103	....	....
No. Ohio Pwr., com.—no par.	14	5	19
No. Ohio Trac. & Lt., 6% pf.	73	64	75
No. Ont. Lt. & Pwr., pf.	76	68	78
No. Ont. Lt. & Pwr., com.	46	41	52
No. States Pwr., 7% pf.	99½	95	100
No. States Pwr. com.	143	103	144½
No. Texas Elec., 6% pf.	50	60	75
No. Texas Elec., com.	40	40	70
Ohio Gas & Elec., 7% pf.	90	87	100
Ohio Pwr., 6% pf.	93	85	95
Ohio Pub. Serv., 7% pf.	97½	97	100
Ohio River Edison, 7% pf.	97	93½	100½
Oklahoma Gas & Elec., pf.	‹93	....	....
Pacific Gas & Elec., 6% pf.	97	92	99
Pacific Gas & Elec., com.	f128	102½	137½
Pacific Pwr. & Lt., 7% pf.	f100	97½	102
Parr Shoals Pwr., 6% pf.	92	90	100
Penn Central Lt. & Pwr., pf.—no par	c69½	60	71
Penn-Ohio Elec., 7% pf.	93	83½	96
Penn-Ohio Pwr. & Lt., 7% pf.	97	91	100
Penn-Ohio Pwr. & Lt., 8% pf.	101	101	110
Penn Pwr. & Lt.—$7—no par.	f105½	98½	106½
Penn Pub. Serv., 7% pf.	96	90	100
Penn Pub. Serv., 6% pf.	85	80	90
Penn W. & Pwr., cap.	k162	126½	185
Phila. Co., pf.—50 (Pitts.)	c 47	37½	49½
Phila. Co., com.	‹60½	51½	64½
Phila. Elec., com.	c 47	37½	57½
Pittsburgh Utilities, pf.	‹ 14½	12½	17½
Portland Elec. Pwr., 7% pf.	98	95	99
Portland Elec. Pwr., 6% pf.	72	70	80
Portland Elec. Pwr., com.	43	40	53
Portland Ry., Lt. & Pwr., pf.	k 72	....	....
Portland Ry., Lt. & Pwr., com.	k 41	....	....
Pwr. Corp. of N. Y., 7% pf.	k110	96	112
Pwr. Corp. of N. Y., com—no par	74	15	89½
Pwr. Sec., pf.—no par.	20	20	55
Pwr. Sec., com.—no par.	15	8	30
Pub. Serv. of N. J., 7% pf.	‹105	99	106
Pub. Serv. of N. J., 8% pf.	‹117	108½	119
Pub. Serv. of N. J., com—no par.	‹ 79½	62½	87½
Pub. Serv. of No. Ill., 6% pf.	a 98	92	100
Public Serv. of No. Ill., 7% pf.	a111	102	111
Pub. Serv. of No. Ill., com.—no par	a127	107½	128½
Pub. Serv. of No. Ill., com.	a127½	118	128½
Pub. Serv. of Okla., 7% pf.	93	87	95
Pub. Serv. Elec. & Gas, 6% pf.	‹ 99	92½	99
Puget Sound Pwr. & Lt., 7% pf.	106	102½	107
Puget Sound Pwr. & Lt., 6% pf.	‹ 84½	....	....
Puget Sound Pwr. & Lt., com.	48	49	61
Radio Corp., of Amer., pf.—50.	46½	45½	54
Radio Corp. of Amer., com.—no par	41½	41½	77½
Republic Ry & Lt., pf.	86	70	85
Republic Ry. & Lt., com.	62	49	65
Rochester Gas & Elec., 5% pf.	95	80	98
Servel Corp., Class A	‹ 31½	....	....
Servel Corp., Class B—no par	56	35	62½
Sierra Pacific Elec., com.	‹ 25	....	....
Sioux City Gas & Elec., 7% pf.	‹ 99	....	....
Southeastern Pwr. & Lt., 7% pf—no par.	97	90	100
Southeastern Pwr. & Lt., com—no par	30	28	34½
So. Calif. Edison, 8% pf.	135	115	128
So. Calif. Edison, 7% pf.	110½	105	107½
So. Calif. Edison, 6% pf.	97½	90	95½
So. Calif. Edison, com.	131	102	149
Southern Cities Utilities, 7% pf.	82	77	100
Southern Cities Utilities, com.	50	30	71
Southern Pwr. & Lt. of Md., pf.	‹107	....	....
Southern Pwr. & Lt. of Md., com.	‹ 32	....	....
Southwestern Pwr. & Lt., A.	‹ 47	....	....
Southwestern Pwr. & Lt., B.	‹ 22½	....	....
Southwestern Pwr. & Lt., 7% pf.	99½	90	102
Springfield (Mo.) Ry. & Lt., 7% pf.	96	92	93
Standard Gas & Elec., 8% pf.	‹ 53½	50½	56½
Standard Gas & Elec., 7% pf.	100½	96	100
Standard Gas & Elec., com.—no par	‹ 56½	40½	61
Standard Pwr. & Lt., 7% pf.	108	95	114½
Superheater, com.—No par.	142	120	152
Tampa Elec., com.	f272	....	....
Tenn. Elec. Pwr., 6% pf.	84	80	85
Tenn. Elec. Pwr., 7% pf.	99	93	103
Tenn. Elec. Pwr., pf.—$6—no par.	k 80	72	84
Tenn. Elec. Pwr. com.—no par.	k 65	....	....
Tex. Pwr. & Lt., 7% pf.	f104	99½	106
Tide Water Pwr., 8% pf.	‹ 98	....	....
Timken Roller Bearing, com.	‹ 53½	37½	59½
Toledo Edison, 8% pf.	112	109	114
Toledo Edison, 7% pf.	101	94	101½
Toledo Edison, com.	25	21	25
Tri-City Ry. & Lt., 6% pf.	85	82	85
United Gas & Elec., 6% pf.	91	80	94
United Gas & Elec., com.—no par.	55	26	57½
United Gas & Elec. (N. J.), 5% pf.	62	55	65
United Gas Impr.—50.	c115½	79½	120½
United Lt. & Pwr., pf.—$4—no par	50	41	51
United Lt. & Pwr., pf.—$6.50—no par.	92	83	99
United Lt. & Pwr., com., A—no par.	146	42	166½
United Lt. & Pwr., com., B—no par.	160	49	100
Utah Pwr. & Lt., 7% pf.	f 99½	97	101½
Utica Gas & Elec., 7% pf.	103	100	104
Utica Gas & Elec., com.	200	100	200
Utilities Pwr. & Lt., 7% pf.	92	90	97
Utilities Pwr. & Lt., com. B—no par	18	12	22
Vermont Hydro-Elec., 7% pf.	92	87	96
Virginia Pwr., 7% pf.	99½	94	107
Virginia Pwr., com.	65	65	92
Virginia Ry. & Pwr., com.	k149	64½	150
Wagner Elec., pf.	b 87	79	92
Wagner Elec., com.—no par	b 35½	26½	50
Washington Wtr. Pwr., com.	129	110	140
West Mo. Pwr., 7% pf.	‹ 91	....	....
West Penn., 7% pf.	‹ 96½	94	100
West Penn. com.	‹113½	97	145
West Penn Pwr., pf.	k108½	104	111
West Virginia Lt., Ht. & Pwr., 7% pf.	94	94½	96½
West Va. Utilities, 7% pf.—50.	41	38	47
Western Elec., 7% pf.	k 83	110	117½
Western Pwr., 7% pf.	96	84	....
Western Pwr., com.—no par.	80	34	102
Western States Gas & Elec., 7% pf.	88	82	92
Western States Gas & Elec., com.	‹ 19	....	....
Westinghouse Elec. & Mfg. com.—50	‹ 73½	66½	84
Weston Elec. Instrument, Cl. A.	‹28	19½	28½
Weston Elec. Instrument, com.	‹ 17½	9½	20½
Wis.-Minn. Lt. & Pwr., 7% pf.	k 90	92	95
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A.	76	76	88
Worthington Pump, pf. B.	62	58	75½
Worthington Pump, com.	‹ 40½	35½	79½
Yadkin River Pwr., 7% pf.	f104½	98	106
Yale & Towne, com.—25.	64	62	70½
BONDS			
Abitibi Pwr. & Paper	6s 1940	100½	98	101½
Adir. Elec. Pwr.	5s 1962	99½	97½	100½
Adir. Pwr. & Lt.	6s 1950	104½	102½	105½
Adir. Pwr. & Lt.	5s 1930	97	94	98
Ala. Pwr.	5s 1946	98½	96	100
Ala. Pwr.	5s 1951	95½	92½	97½
Ala. Pwr.	6s 1951	104½	101½	105
Ala. Trac. Lt. & Pwr.	5s 1962	107½	86	105
Aluminum Co. of Amer.	7s 1933	106½	106½	107½
Amer. Bosch Magneto	8s 1936	k103	86	101
Amer. Gas & Elec.	5s 2007	91	90	93½
Amer. Gas & Elec.	6s 2014	98½	96½	98½
Amer. Pwr. & Lt.	6s 2016	95½	94	98
Amer. Pub. Serv.	6s 1942	98½	94	99½
Amer. Wtr. Wks. & Elec.	5s 1934	96	92½	98
Amer. Wtr. Wks. & Elec.	6s 1975	95	94½	95
Anaconda Copper	6s 1929	102½	102½	104
Anaconda Copper	6s 1953	101	99½	102
Anaconda Copper	7s 1938	104½	99½	105½
Appalachian Pwr.	5s 1941	98½	96	99½
Appalachian Pwr.	6s 2024	93½	86½	94½
Appalachian Pwr.	7s 1936	105½	105½	106½
Arizona Pwr.	6s 1933	100	97½	101½
Arizona Pwr.	6s 1947	95½	90	96
Ark. Central Pwr.	6s 1948	100½	98½	102½
Ark. Lt. & Pwr.	6s 1945	103	100	104½
Ark. Lt. & Pwr.	6s 1954	98	92½	99½
Assoc. Gas & Elec.	6s 1965	93½	92	96
Assoc. Gas & Elec.	6½s 1954	99	94½	106
Binghamton Lt., Ht. & Pwr.	5s 1946	98½	94½	99
Birmingham Elec.	6s 1954	101½	99	103
Birmingham Ry., Lt. & Pwr.	4½s 1954	87½	85	89½
Broad River Pwr.	6½s 1934	100	99	102
Brooklyn Edison	5s 1949	101½	99½	103
Brooklyn Edison	6s 1930	104½	103½	106
Buffalo Gen. Elec. 1st.	5s 1939	101½	100½	101½
Buffalo Gen. Elec. 1st & Ref.	5s 1939	101	100	100½
Burlington Ry. & Lt.	5s 1932	94½	90	96
Butte Elec. & Pwr.	5s 1951	100	99	100½
Calif. Gas & Elec.	5s 1937	100½	98	101½
Canadian Lt. & Pwr.	5s 1949	42	36	62
Canton Elec.	5s 1937	99½	99	100½
Carolina Pwr. & Lt.	5s 1938	99½	98½	100½
Carolina Pwr. & Lt.	6s 1953	104½	103½	105
Cedar Rapids Mfg. & Pwr.	5s 1953	99	98½	100½
Central Ark. Ry. & Lt.	5s 1928	99	98½	100
Central Ga. Pwr.	5s 1938	95½	93	97
Central Ill. Lt.	5s 1943	98½	94	99½
Central Ill. Publ Serv.	5s 1952	89½	84½	92½
Central Ill. Pub. Serv.	5½s 1950	96	96½	98
Central Ill. Pub. Serv.	6s 1944	100	96½	101½
Central Ind. Pwr.	6s 1947	98½	95½	99½
Central Ia. Pwr. & Lt.	6s 1944	99	97	100½
Central N. Y. Gas & El.	5s 1941	95	94	97½
Central Pwr. & Lt.	6s 1946	100½	97½	101½
Central Pwr. & Lt.	6½s 1952	101½	94	102
Central States Elec.	5s 1926	k 99	98	100½
Chattanooga Ry. & Lt.	5s 1956	84	81	85
Cincinnati Gas & Elec.	5s 1956	101½	98½	104½
Cincinnati Gas & Elec.	5½s 1967	105½	100½	105
Cities Service	6s 1966	90½	90	91½
Cities Service	7s B 1966	178	150½	178½
Cities Service	7s C 1966	126½	111	128
Cities Service	7s D 1966	101½	98½	106½
Cities Service	7s E 1966	‹111	111	112½
Cities Service Pwr. & Lt.	6s 1944	93½	93½	95
City Lt. & Trac., Sedalia, Mo.	5s 1952	84	74	85½
Cleveland Elec. Illum.	5s 1939	101½	100	102
Cleveland Elec. Illum.	5s 1954	100½	97½	101
Cleveland Elec. Illum.	7s 1941	110	109	111½
Colorado Pwr.	5s 1953	95½	93	96½
Columbia Gas & Elec.	5s 1927	99½	99½	100½
Columbia Ry., Gas & El.	5s 1936	92	92½	94½
Columbus, Dela. & Marion Elec.	5s 1937	85	83	88
Columbus, Dela. & Marion Elec.	6s 1937	95	91	98
Columbus Elec. & Pwr.	6s 1947	‹102	....	....
Columbus Ry., Pwr. & Lt.	5s 1940	95½	93½	98
Columbus Ry., Pwr. & Lt.	6s 1941	103	101½	105
Commonwealth Edison.	5s 1943	102	99½	102½
Commonwealth Edison.	5s 1953	99½	98½	101
Commonwealth Edison.	5s 1954	99½	98	101
Commonwealth Pwr.	6s 1947	103	97½	103½
Community Pwr. & Lt.	6s 1950	96	94½	98
Conn. Ry. & Ltg.	4½s 1951	87	90½	92½
Consol. Cities., Lt., Pwr. & Trac.	5s 1962	80½	75½	82½
Consol. Elec.	5s 1955	97½	94	98½
Consol. Gas of N. Y.	5½s 1945	104	101½	105
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s 1935	c 97½	93½	97½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s 1949	c105½	104½	106½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5½s 1952	k104	101½	105½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s 1965	c 99½	99	100½
Con. Gas, Elec. Lt. & Power of Baltimore	5½s 1952	104	102½	105½
Consumers Elec. Lt. & Pwr.	5s 1936	94½	93	96½
Consumers Pwr.	5s 1936	100	99	100½
Consumers Pwr.	5s 1952	97	90½	100
Consumers Pwr.	5½s 1954	103	99	104½
Continental Gas & Elec.	5s 1927	100	99½	100½
Continental Gas & Elec.	6s 1947	99½	98	101
Continental Gas & Elec.	6½s 1964	98½	96½	101
Continental Gas & Elec.	7s 1954	104½	99	103½
Cumberland County Pwr. & Lt.	5s 1942	94½	92	96½
Dallas Pwr. & Lt.	6s 1949	104½	103	105½
Dayton Ltg.	5s 1937	99½	98½	100½
Dayton Pwr. & Lt.	5s 1941	99½	97	100
Defiance Gas & Elec.	5s 1942	95	88½	97½
Denver Gas & Elec.	5s 1949	97½	97	100
Denver Gas & Elec. Lt.	5s 1951	93	92	95½
Des Moines Elec.	5s 1938	98	98	100½
Detroit Edison.	5s 1933	100½	99½	102
Detroit Edison.	5s 1940	101½	99½	102½
Detroit Edison.	5s 1949	100	97½	101½
Detroit Edison.	5s 1955	k 99½	97½	100
Detroit Edison.	6s 1932	136	110½	155
Detroit Edison.	6s 1940	107½	106½	108½
Detroit Edison.	7s 1928	k150½	125	156½
Detroit Edison.	7s 1929	k150½	114	150½
Detroit Edison.	7s 1930	k140½	121½	158½
Dominion Pwr. & Trans.	5s 1932	95½	95½	98½
Driver-Harris.	8s 1931	96	88	97
Dubuque Elec.	6s 1942	101½	97½	102
Duke-Price Pwr.	6s 1949	101	98½	103
Duquesne Ls.	6s 1949	105½	104½	107½
Duquesne Lt.	5½s 1949	105	104	106
Durham Pub. Serv.	7s 1949	100	97½	101½
East Penn. Elec.	6s 1953	104½	100½	105½
East Oregon Lt. & Pwr.	6s 1929	100	97½	100½
East. Tex. Elec.	5s 1942	‹ 95	....	....
Economy Lt. & Pwr.	5s 1956	98½	96	99½
Edison Elec. Illum. of Bkln.	4s 1939	92	89	95½
Edison Elec. Illum. (N. Y.)	5s 1995	102	99½	103
El Paso Elec.	5s 1932	‹102	....	....
El Paso Elec.	5s 1950	‹ 94	....	....
Elec. Pwr. Corp. (Germany)	6½s 1950	87½	86½	88½
Elmira Wtr., Lt. & R. R.	5s 1956	95	92½	96½
Empire Dist. Elec.	5s 1949	91	86½	91½
Erie Ltg.	5s 1967	98	95½	99½
Evansville Gas & Elec. Lt.	5s 1932	98½	96	100
Federal Lt. & Trac.	5s 1942	92½	88	101½
Federal Lt. & Trac.	6s 1942	100½	96½	103
Federal Lt. & Trac.	6s 1954	93½	91½	94½
Ft. Smith Lt. & Trac.	5s 1936	78	76½	82½
Ft. Worth Pwr. & Lt.	5s 1931	99½	99	100½
Galveston Elec.	5s 1940	91	86½	93½
General Elec.	3½s 1942	87	83	90½
General Elec.	5s 1952	k107½	101½	107½
Georgia Carolina Pwr.	5s 1952	85½	82	90
Ga. Lt., Pwr. & Rys.	5s 1941	87½	86½	90½
Ga. Ry. & Elec.	5s 1932	98½	98½	100½
Ga. Ry. & Elec.	5s 1949	92	88	94½
Ga. Ry. & Pwr.	5s 1954	93½	89½	96
Ga. Ry. & Pwr.	6s 1947	102½	100½	103½
Ga. Ry. & Pwr.	7s 1941	104½	105	107
German Gen. Elec.	7s 1945	95½	92	96½
Great Cons. Elec. Pwr. (Japan)	6½ 1950	86	86	86½
Great Cons. Elec. Pwr. (Japan)	7s 1944	90½	87½	91½
Great Falls Pwr.	5s 1940	103	99½	102½
Great Northern Pwr.	5s 1935	98½	96	99
Great Western Pwr.	5s 1946	98½	95	99½
Great Western Pwr.	5½s 1955	98	96	99
Great Western Pwr.	6s 1949	100½	100	102½
Great Western Pwr.	6s 1952	101½	99½	102½
Hamburg Elec.	7s 1935	95½	95½	96
Havana Elec. Ry., Lt. & Pwr.	5s 1954	92½	85½	95½
Holtwood Pwr.	6s 1954	103½	00	104½
Houston Ltg. & Pwr.	5s 1931	99½	198½	100
Houston Ltg. & Pwr.	5s 1953	93½	90½	95½
Houston Ltg. & Pwr.	5½s 1954	99½	97	101½
Hydraulic Pwr.	5s 1951	101	99½	102
Hydraulic Pwr.	5s 1950	101	100	103
Idaho Pwr.	5s 1947	96½	93	97½
Ill. Elec. Pwr.	6s 1943	102	99½	103½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. ‹Bid, low, high, Monday, Nov. 23. fBid, low, high Wednesday, Nov. 25. kLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday, Nov. 21	Low 1925	High 1925
BONDS (Continued)				
Ill. Pwr.	5s	1933	93¼	93	95½
Ill. Pwr. & Lt.	6s	1953	101½	100½	102½
Ill. Pwr. & Lt.	7s	1953	103	99	102½
Ind. Elec.	6s	1947	98	97	99½
Ind. Gen. Serv.	5s	1948	96	92	97½
Ind. Lighting	4s	1958	80½	78	83
Indiana & Mich. Elec.	5s	1957	98½	97½	99½
Indiana & Mich. Elec.	5s	1955	95	95	98
Ind. Pwr.	7½s	1941	£105½	104	106
Ind. Service	5s	1950	89½	86½	92
Ind. Service	6s	2020	85	73	88½
Ingersoll-Rand	5s	1935	99¼	92	99½
Interstate Elec.	6s	1933	95	95	99½
Interstate Pwr.	6s	1944	98	95	99½
Interstate Pwr.	7s	1934	99½	97	100½
Interstate Pub. Serv.	6s	1948	98	96	100½
Iowa Ry. & Lt.	5s	1932	97½	97	99½
Jersey Cent. Pwr. & Lt.	5½s	1945	95½	95	98
Kansas City Pwr. & Lt.	5s	1952	100	95½	102
Kansas Elec. Pwr.	6s	1937	100	97½	102
Kansas Elec. Pwr.	6s	1943	100½	97½	102
Kansas Gas & Elec.	6s	1952	101½	98½	103½
Kansas Gas & Elec.	6s	2022	91	86½	94½
Kentucky Utilities	6s	1949	100½	97	101½
Kings County Elec. Lt. & Pwr.	5s	1937	102½	99	103
Kings County Elec. Lt. & Pwr.	6s	1997	119½	114½	120½
Kings County Ltg.	5s	1954	98½	89	101½
Kings County Ltg.	6½s	1954	107	103½	108½
Knoxville Ry. & Lt.	5s	1946	93	88	95½
Laclede Gas Lt.	5s	1934	100	98½	101½
Laclede Gas Lt.	5½s	1953	100½	95½	102
Laurentian Pwr.	6s	1936	100	96	100½
Laurentide Pwr.	6s	1936	£99	96	100
Laurentide Pwr.	5s	1946	99½	97	100½
Laurentide Pwr.	6s	1936	£99	....	....
Lehigh Pwr. Sec. (notes)	6s	1927	101	100½	101½
Lincoln Gas & Elec.	5s	1941	91	92½	95½
Long Island Ltg.	5s	1936	99½	98½	100½
Long Island Ltg.	6s	1954	99½	99½	102
Long Island Ltg.	6s	1948	104	102	105½
Long Island Ltg.	6s	1954	100½	99½	102
Los Angeles Gas & Elec.	5s	1939	99	98	101½
Los Angeles Gas & Elec.	5½s	1943	98	94	99½
Los Angeles Gas & Elec.	5½s	1947	98	96	99½
Los Angeles Gas & Elec.	5½s	1949	97½	95½	99½
Los Angeles Gas & Elec.	6s	1942	102½	101½	104½
Louisiana Pwr.	6s	1944	97½	97	99
Louisville Gas & Elec.	5s	1952	97½	90½	99½
Louisville Gas & Elec.	5½s	1954	101½	99	102
Lower Austrian Hydro Elec.	6½s	1944	85½	85½	86½
Luzerne County Gas & Elec.	5s	1948	98	97	99½
Luzerne County Gas & Elec.	7s	1944	104½	99½	104½
Luzerne County Gas & Elec.	6s	1954	102½	99	105
Madison River Pwr.	5s	1935	100	99½	101
Manila Elec.	7s	1942	101½	97½	102½
Manila Elec. Ry. & Ltg.	5s	1953	89	85	92
Manitoba Pwr.	7s	1941	103½	98½	104½
Memphis Pwr. & Lt.	5s	1948	98½	95	99½
Metropolitan Edison	6s	1952	103½	101½	106
Metropolitan Edison	5s	1953	95½	91½	97
Metropolitan Pwr.	6s	1953	102	100	104
Michigan Lt.	5s	1946	98	97½	100
Michigan No. Pwr.	5s	1941	96	95½	97
Milwaukee Elec. Ry. & Lt.	5s	1926	100	99½	101½
Milwaukee Elec. Ry. & Lt.	4½s	1931	96½	94½	97
Milwaukee Elec. Ry. & Lt.	5s	1951	98	94	100
Milwaukee Elec. Ry. & Lt.	5s	1961	89½	84½	92½
Milwaukee Elec. Ry. & Lt.	6s	1953	101	98½	104
Minn. Pwr. & Lt.	5s	1955	95	95	97
Minn. Pwr. & Lt.	6s	1950	103½	101½	105½
Miss. River Pwr.	5s	1951	99	96½	100½
Miss. River Pwr.	7s	1935	102	102	104
Mo. Edison Elec.	5s	1927	*b* 99½	99½	100½
Mobile Elec.	5s	1946	96	91	97½
Montana Pwr.	5s	1943	100	97½	100½
Montgomery Lt. & Wtr. Pwr.	5s	1943	£93	86½	93½
Montreal Lt., Ht. & Pwr.	4½s	1932	97	97	98½
Montreal Lt., Ht. & Pwr.	5s	1933	98½	98½	101
Montreal Pub. Serv.	5s	1942	94½	89	94½
Mountain States Pwr.	6s	1938	98½	96½	100½
Nashville Ry. & Lt.	5s	1953	97	94	98
Nashville Ry. & Lt.	5s	1958	89½	84	88½
Nassau Lt. & Pwr.	5s	1927	99½	98	101
Nassau & Suffolk Ltg.	5s	1945	89	82	91
National Pwr. & Lt.	7s	1972	102	97	104½
National Pub. Serv.	6½s	1955	94½	94	96½
Nebraska Pwr.	5s	1949	99½	97	100
Nebraska Pwr.	6s	2022	97	89½	96½
Nevada-Calif. Elec.	6s	1946	99	96½	100½
Nevada-Calif. Elec.	6s	1950	99	96½	100½
New England Pwr.	5s	1951	101	100½	103
New Jersey Pwr. & Lt.	5s	1936	96	92½	97½
New Orleans Pub. Serv.	4½s	1935	86½	83½	88½
New Orleans Pub. Serv.	5s	1952	91½	81½	92
New Orleans Pub. Serv.	5s	1955	90½	88½	92½
New Orleans Pub. Serv.	6s	1949	92	86½	93½
N. Y. & Queens Elec. Lt. & Pwr.	5s	1930	99½	99½	101
N. Y. & Westchester Ltg.	4s	2004	78	76	81
N. Y. & Westchester Ltg.	5s	1954	96	93	97
New York Edison	6½s	1941	114½	112	115½
New York Edison	5s	1944	101½	99½	102
N. Y. Gas & Elec. Lt., Ht. & Pwr.	5s	1948	103½	100½	104½
N. Y. Gas & Elec. Lt., Ht. & Pwr.	4s	1949	89	86	90½
N. Y. State Gas & Elec.	5½s	1962	100½	96	101½
Newport News & Hampton Ry., Gas & Elec.	5s	1944	86	84	93
Niagara Falls Pwr.	5s	1932	102	100	103
Niagara Falls Pwr.	6s	1932	105½	103½	106½
Niagara Falls Pwr.	6s	1950	105½	105½	106½
Niagara, Lock. & Ont. Pwr.	5s	1954	£98½	104½	110
Niagara, Lock. & Ont. Pwr.	5s	1955	98½	97½	100
Niagara, Lock. & Ont. Pwr.	6s	1958	£109½	104½	110½
Norfolk Ry. & Lt.	5s	1949	94	93	95½
No. Amer. Edison	6s	1952	102	96½	102½
No. Amer. Edison	6½s	1948	104½	100½	106
No. Amer. Lt & Pwr.	7s	1954	99½	97	100
North Caro. Pub. Serv.	5s	1934	90½	89	93½
North Caro. Pub. Serv.	6s	1954	94	91½	96
North Caro. Pub. Serv.	6½s	1944	98	96	100
North Shore Elec.	5s	1940	99½	97½	100
No. Calif. Pwr.	5s	1948	99½	98½	100½
No. Ind. Gas & Elec.	5s	1929	99	97	100½
No. Ind. Gas & Elec.	6s	1952	102	99½	103½
Northern N. Y. Utilities	5½s	1949	99	96½	100½
No. Ohio Trac. & Lt.	4s	1933	86	82	87½
No. Ohio Trac. & Lt.	5s	1956	81	78	87
No. Ohio Trac. & Lt.	6s	1926	98½	98½	100
No. Ohio Trac. & Lt.	6s	1947	94½	91	97
No. Ontario Lt. & Pwr.	6s	1931	98½	95½	99½
No. States Pwr.	6½s	1933	138	105½	141
No. States Pwr. (notes)	6½s	1933	104	99½	104½
No. States Pwr.	6s	1948	102½	101	104½
No. States Pwr.	6s	1941	105	103	107½
No. States Pwr.	5s	1941	97½	93	99½
No. Tex. Elec.	5s	1940	74	74	82½
Northwestern Elec.	6s	1935	101	101½	102½
Northwestern Pub. Serv.	6½s	1948	99	97½	100½
Ohio Pwr.	5s	1952	94½	89	96½
Ohio Pwr.	6s	1953	103	101	104½
Ohio Pwr.	6s	2024	95½	88½	95½
Ohio Pwr.	7s	1951	106	106½	107½
Ohio Pub. Serv.	5s	1954	91	87	93
Ohio Pub. Serv.	6s	1953	100½	98	101½
Ohio Pub. Serv.	7½s	1946	112	108	112½
Ohio Pub. Serv.	7s	1947	111½	107½	111½
Ohio River Edison	6s	1948	102½	98½	104
Okla. Gas & Elec.	5s	1950	92½	93½	96
Okla. Gas & Elec.	6s	1940	96½	96	98½
Ontario Pwr. of Niagara Falls	5s	1943	99½	98	100½
Ontario Transmission	5s	1945	99½	97	99½
Ozark Pwr. & Wtr.	5s	1952	76	75	81
Pacific Coast Pwr.	5s	1940	99½	97½	99½
Pacific Gas & Elec.	5s	1942	97½	93½	99
Pacific Gas & Elec.	5s	1955	£93½	94	95½
Pacific Gas & Elec.	5½s	1952	101½	97½	102½
Pacific Gas & Elec.	6s	1941	105½	103½	106½
Pacific Lt. & Pwr.	5s	1951	99½	98½	100½
Pacific Lt. & Pwr.	5s	1942	99	98	101½
Pacific Pwr. & Lt.	5s	1930	99	98	100
Pacific Pwr. & Lt.	5s	1953	£96½	....	....
Parr Shoals Pwr.	5s	1952	94	92½	97
Paterson & Passaic Gas & Elec.	5s	1949	99½	96	100½
Penn Central Lt. & Pwr.	6s	1953	103	102	104½
Penn Edison	5s	1946	96½	94	97½
Penn Elec.	6½s	1954	98½	96	99½
Penn. Elec.	6s	1955	93½	93½	95
Penn Ohio Elec.	6½s	1938	104½	99½	105
Penn Ohio Pwr. & Lt.	5½s	1954	97½	95	99½
Penn Ohio Pwr. & Lt.	6s	1939	97½	94	99
Penn Pwr. & Lt.	5s	1952	97½	95	98½
Penn Pwr. & Lt.	5s	1953	97½	95	98½
Penn Pwr. & Lt.	6s	1953	104½	102½	105½
Penn Pwr. & Lt.	7s	1951	106	106	107½
Penn Pub. Serv.	5s	1954	95	93	96½
Penn Pub. Serv.	6s	1947	103	103	105½
Penn Wtr. & Pwr.	5s	1940	101½	99½	102½
Penn Wtr. & Pwr.	5½s	1953	102	99½	103
Phila. Co.	6s	1944	104½	101½	105
Phila. Co.	5½s	1938	98½	93½	100
Phila. Co.	5s	1951	94½	95	97
Phila. Co.	5s	1949	*c* 102½	94½	104
Phila. Elec.	6s	1941	*c* 107½	106	108½
Phila. Elec.	5s	1966	*c* 102½	100	104½
Phila Elec.	4s	1966	*c* 85	83	85
Phila. Elec.	5s	1960	*c* 101½	100	104
Phila. Elec.	5½s	1947	*c* 106½	103½	107
Phila. Elec.	5½s	1953	*c* 106½	104½	107½
Portland Elec. Pwr.	6s	1947	99	96½	100½
Portland Gen. Elec.	5s	1935	99½	98½	100½
Portland Ry., Lt. & Pwr.	5s	1942	88½	84½	92
Portland Ry., Lt. & Pwr.	6s	1947	100	94	100½
Portland Ry., Lt. & Pwr.	7½s	1946	106½	104½	108
Potomac Edison	6s	1949	98½	96	100
Potomac Edison	6½s	1948	102	99	103½
Potomac Elec. Pwr.	5s	1929	99½	99	100½
Potomac Elec. Pwr.	5s	1936	99½	98½	100
Power Corp. of N. Y.	6s	1942	99½	97½	101
Power Corp. of N. Y.	6½s	1942	104	99½	103½
Power Securities	6s	1949	£79	....	....
Pub. Lt. & Pwr.	5s	1945	68	64	79
Pub. Serv. Co. of Colo.	5½s	1954	93½	92	96½
Pub. Serv. Co. of Colo.	6s	1953	99	98	101
Pub. Serv. Co. of Colo.	7s	1933	101	98½	102½
Pub. Serv. Corp. of N. J.	5s	1959	105	103½	105½
Pub. Serv. Corp. of N. J.	6s	1944	99½	95	100
Pub. Serv. Co. of No. Ill.	5s	1956	96	91	97½
Pub. Serv. Co. of No. Ill.	5½s	1962	101	96½	102½
Pub. Serv. Co. of No. Ill.	5½s	1964	101	96½	102½
Pub. Serv. Co. of Okla.	6s	1949	99	97½	103
Pub. Serv. Elec. & Gas.	5½s	1959	103½	98½	105½
Pub. Serv. Elec. & Gas.	5½s	1964	103½	99½	105
Public Utilities, (Evansville, Ind.)	6s	1929	100½	99	101
Puget Sound Pwr.	5s	1933	98½	98½	100½
Puget Sound Pwr. & Lt.	5½s	1949	99½	96½	100½
Quebec Pwr.	6s	1953	101½	98½	102½
Queensborough Gas & Elec.	5s	1952	99	96½	100½
Queensborough Gas & Elec.	6s	1953	104½	101	105
Rhine-Westphalia Electric Power	7s	1950	94½	94½	95
Rio de Janeiro Tram., Lt. & Pwr.	5s	1935	93	85	91½
Robbins & Myers	7s	1952	60	57½	73½
Rochester Gas & Elec.	5½s	1948	103½	102	104½
Rochester Gas & Elec.	7s	1946	110½	109½	111
Rockford Elec.	5s	1939	99½	98	101
St. Joseph Ry., Lt., Ht. & Pwr.	5s	1937	91½	85½	93
St. Paul Gas Lt.	5s	1944	101	98½	100½
St. Paul Gas Lt.	5½s	1954	101½	98	102½
Salt River Valley Wtr.	6s	1938	£100	....	....
Salmon River Pwr.	5s	1952	100½	98½	101½
San Antonio Gas & Elec.	5s	1949	97	96	98½
San Antonio Pub. Serv.	6s	1952	101½	99½	104
San Diego Cons. Gas & Elec.	5s	1939	100	98	101
San Diego Cons. Gas & Elec.	6s	1939	101½	99	103
San Joaquin Lt. & Pwr.	5s	1945	98½	98	100
San Joaquin Lt. & Pwr.	6s	1950	102½	101	103½
San Joaquin Lt. & Pwr.	6s	1952	101	99½	103½
San Joaquin Lt. & Pwr.	6s	1954	100½	99	101
Sauda Falls	5s	1955	98½	98	98½
Savannah Elec. & Pwr.	7½s	1941	£104½	....	....
Saxon Pub. Wks. (Germany)	7s	1945	92½	90½	94½
Scranton Electric	5s	1937	101½	97	101½
Seattle Elec.	5s	1930	99½	99	101
Seattle Elec.	5s	1929	100	99	100½
Seattle Elec.	5s	1939	92½	90	93½
Seattle Ltg.	5s	1949	91½	85½	92
Shawinigan Wtr. & Pwr.	5s	1934	100	100	101½
Shawinigan Wtr. & Pwr.	5½s	1950	103½	101½	104
Shawinigan Wtr. & Pwr.	6s	1950	105	104	106½
Siemens & Halske	7s	1928	96½	92½	99½
Siemens & Halske	7s	1935	95½	90½	96½
Sierra & San Francisco Pwr.	5s	1949	76½	75	80
Sierra & San Francisco Pwr.	6s	1949	89	87	93½
Sioux City Gas & Elec.	6s	1947	101½	99	102
Sioux City Gas & Elec.	6s	1949	101½	99	102
So. Caro. Gas & Elec.	6s	1942	84	87	93
So. Caro. Gas & Elec.	6s	1932	75	83	88
Southeast Pwr. & Lt.	6s	2025	91	88	91½
So. Cal. Edison	5s	1939	99½	99½	101
So. Cal. Edison	5s	1944	95	92½	96½
So. Cal. Edison	5½s	1944	101½	98½	102
So. Cal. Edison	6s	1943	102½	100½	104
So. Cal. Edison	6s	1944	104½	102½	105½
So. Cities Utilities	5s	1931	99	99	102
Southern Colo. Power	6s	1947	98½	93½	99½
So. Public Utilities	5s	1943	99½	97½	100½
So. Sierras Pwr.	6s	1936	102½	102	104½
So. Utilities	6s	1933	102	97½	102½
So. Wisconsin Pwr.	5s	1938	90	88	93
Southwestern Gas & Elec.	5s	1932	96½	94	98
Southwestern Gas & Elec.	6s	1957	96½	89	97½
Southwestern Pwr. & Lt.	5s	1943	94½	90	97
Southwestern Pwr. & Lt.	6s	2022	93½	88½	94½
Southwestern Utilities	8s	1936	97	96	102½
Springfield Ry. & Lt.	5s	1926	99½	98½	100
Standard Elec. of Cal.	5s	1939	98½	98½	100½
Standard Gas & Elec.	6s	1935	99½	91	101
Staten Island Edison	6½s	1953	104½	104	106½
Syracuse Ltg.	5s	1951	99½	97	101½
Syracuse Ltg.	5½s	1954	102	100½	103
Tampa Elec.	5s	1933	£99	....	....
Tenn. Elec. Pwr.	6s	1947	102½	99½	104½
Tenn. Pwr.	5s	1962	94½	90	96½
Tex. Pwr. & Lt.	5s	1937	98	97	99½
Tex. Pwr. & Lt.	6s	2022	97	90	96½
Tide Water Pwr.	6s	1942	99½	98½	101
Tide Water Pwr.	7s	1937	98½	97½	101½
Toho Elec. Pwr. (Japan)	7s	1955	100½	97	101½
Tokyo Elec. (Japan)	6s	1928	99	98½	99½
Toledo Edison	5s	1947	98½	97	100
Toledo Edison	7s	1941	109	108½	110
Toledo Gas Elec. & Htg.	5s	1935	96½	97½	100½
Toledo Trac., Lt. & Pr. notes	5½s	1930	98	97½	100½
Topeka Edison	5s	1930	98½	97	100
Topeka Ry. & Lt.	5s	1933	95½	90½	96½
Trenton Gas & Elec.	5s	1949	99½	98	100
Tri-City Ry. & Lt.	5s	1930	98½	96½	99½
Twin State Gas & Elec.	5s	1953	92½	84	94½
Tyr-l Hydro-Elec. Pwr.	7½s	1955	96½	94½	97
Union Elec. Lt. & Pwr.	5s	1932	100½	99½	102
Union Elec. Lt. & Pwr.	5s	1933	100	98½	101
Union Elec. Lt. & Pwr.	5s	1954	99	97½	100
Union Elec. Lt. & Pwr.	5½s	1954	100½	100	104
United Elec. of N. J.	4s	1949	87½	85	88½
United Elec. Lt. & Pwr.	4½s	1929	£98½	98½	99
United Gas & Elec.	6s	1945	99	96	101
United Lt. & Pwr. notes	5½s	1928	99½	98	100
United Lt. & Pwr.	5½s	1959	93½	89½	97
United Lt. & Pwr.	6½s	1974	95½	92½	97½
United Lt. & Rys.	5s	1932	95½	93½	97½
United Lt. & Rys.	6s	1926	99½	100½	101½
United Lt. & Rys.	6s	1952	98½	95½	100½
United Lt. & Rys.	6s	1973	89	87	92
United Pwr. & Lt.	6s	1944	101½	99	103
Utah Lt. & Trac.	5s	1944	88	83½	91½
Utah Pwr. & Lt.	5s	1944	95	91	98½
Utah Pwr. & Lt.	6s	1944	102½	102	104½
Utah Pwr. & Lt.	6s	2022	92½	88½	94½
Utica Elec. Lt. & Pwr.	5s	1950	101½	100½	102
Utica Gas & Elec.	5s	1957	100½	98½	103
Vermont Hydro-Elec.	6s	1929	100	98½	100½
Vicksburg Lt. & Trac.	5s	1932	91	89	93½
Virginian Pwr.	5s	1942	93½	88	96
Virginian Pwr.	6½s	1954	101½	99	102½
Virginia Ry. & Pwr.	5s	1943	97½	93½	99
Wagner Elec. Mfg.	7s	....	101½	100	102
Washington Coast Util.	6s	1941	101½	99½	101½
Washington Wtr. Pwr.	5s	1939	101½	99½	101½
West Penn Pwr.	5s	1963	99½	93½	99½
West Penn Pwr.	5s	1946	99½	93½	100½
West Penn Pwr.	5½s	1953	103½	100½	105½
West Penn Pwr.	7s	1946	107½	104½	107½
West Virginia Lt., Ht. & Pwr.	6s	1929	100	95	100
West Virginia Utilities	6s	1935	95	91	98
Westchester Ltg.	5s	1950	101½	98	102
Western Elec.	5s	1944	100½	98	101½
Western N. Y. Utilities	5s	1946	96½	90½	97½
Western Pwr.	6½s	1954	100	97	100½
West. States Gas & Elec.	5s	1941	97½	95	99½
West. States Gas & Elec.	6s	1947	99	97	100½
Westinghouse Elec. & Mfg.	7s	1931	106½	105½	108½
Wisconsin Elec. Pwr.	5s	1954	98½	93½	99½
Wisconsin Gas & Elec.	5s	1952	99	97	100½
Wis.-Minn. Lt. & Pwr.	5s	1944	95½	93	96½
Wis. Ry., Lt. & Pwr.	5s	1933	92½	87½	93½
Wis. River Pwr.	5s	1941	90½	88	92½
Yadkin River Pwr.	5s	1941	98½	96½	99½
Yarmouth Lt. & Pwr.	5s	1937	83	82	87
Yarmouth Lt. & Pwr.	8s	1951	98	97	102

Stock Exchange: *c*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco. *i*Bid, low, high, Monday, Nov. 23. *j*Bid, low, high Wednesday, Nov. 25. *k*Latest quotations available.